OF THE BENEFITS AND COSTS OF AERONAUTICAL RESEARCH AND TECHNOLOGY MODELS

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Appendix A COMMON BLOCK AND VARIABLE DEFINITION

Table A.1 presents common block definition and use information for all common blocks in the ABC-ART program. For each common block, the routines where variables in the block are initially defined, redefined, and used are shown.

In Tables A.2, A.3, and A.4 alphabetical lists of all variables in the Fleet Accounting, Airframe Manufacturer, and Air Carrier Modules, respectively, are presented. For each variable, the mode type (real, integer, etc.), the means by which values are assigned (input, calculation, etc.), the dimension if an array, the parameters referenced by each array subscript (aircraft type, year, etc.), the common block membership, the routine where a value was initially assigned, and the definition of the variable are given. The codes used in these tables are given in footnotes to the tables.

Table A.1
COMMON BLOCK DEFINITION AND USAGE

BLOCK	RC	UTINES WHERE COMMON BLOCK	K IS
NAME	DEFINED	REDEFINED	USED
ACCASHF	CASHFLW		CASHFLW, INRR, INTROR
ACCINCO	REVENUE		REVENUE, CASHFLW, INTROR
ACCOST	CASHFLW		CASHFLW
ACCUMS	SHARE		BET, SHARE, CURVES
CASHFLO	CASHFLW		CASHFLW, INRR, INTROR
COMPCST	COMPCOS		COMPCOS, CASHFLW, INTROR
COSTOT	ACCOST, COMPCOS		ACCOST, COMPCOS, COSTPR
CSHFLO	ACCOST		ACCOST, COMPCOS
CUMOUT	ACCOST		ACCOST, COSTPR
DELAY	RDTE		RDTE
DELIVER	PLANT		PLANT, REVENUE, COMPCOS (inactive)
DEMAND	INPLANT		INPLANT, PLANT
IN			OPLIFE, REPAY, DEPSUB, NETSUB, SUM, CFSUB, DCFSUB, OUTPUT, TAX
INCOME	REVENUE		REVENUE, CASHFLW, INTROR
INDICES	BET		BET, AMORITZ, MODS, BUYS, PLOTSGL, INPLANT
LIFETIM	INPLANT		PLANT, INPLANT
MARKET	BET		BET, BUYS
MAXP	PLANT		PLANT
MODS	BET		BET, MODS
ORDER	PLANT		PLANT, REVENUE, COMPCOS (mactive)
PERIOD	RDTE		RDTE
PLOTDAT	BET		BET, CURVES, PLOTTER
POP	BET		BET, AMORITZ, BUYS, PLOTSGL, INPLANT
PRDSCHL	PLANT		PLANT, COMPCOS (inactive)
PRICEO	ACPRICE	Inplant	ACPRICE, INPLANT, REVENUE
PRINT	INPLANT		INPLANT, INTROR
PRODIDS	COMPCOS		COMPCOS, INTROR
PRODUCT	PLANT		PLANT, COMPCOS
RDTECMP	RDTE		RDTE, CASHFLW, INTROR

Table A.1
COMMON BLOCK DEFINITION AND USAGE (Concluded)

BLOCK		ROUTINES WHERE COMMON	BLOCK IS
NAME	DEFINED	REDEFINED	USED
RDTELBL	RDTE		RDTE, INTROR
RESULTS	BET		BET, MODS, BUYS, PLOTSGL
SHARES	SHARE		BET, SHARE
STARTER	BET	}	BET, CURVES, PLOTTER, PLOTSGL
STARTUP	INPLANT		INPLANT, PLANT
STATLIST	BET	MODS	BET, MODS, AMORTIZ, PLOTSGL
OTAL	PLANT		PLANT, COMPCOS, REVENUE
TOTALS	BET	BET	BET, SHARE
RDTEC	ACCOST		ACCOST, RDTE, COSTPR, COMPCOS
TTLCMP	ACCOST		ACCOST, COMPCOS, COSTPR
rts	PLANT	PLANT	PLANT, RDTE, COMPCOS (inactive

Table A.2

DEPINITION OF FLEET ACCOUNTING MODULE VARIABLES

NAMIABLE TYPE WALLE NAME AND THORES OF THORES OF THE ARRAY INDEXED COMMON BET INC. CARD A I 8 DI WITTON DATABLE SCREEPE AND SCREEP TOWARD CARD DATA OF A STARTER SCREEP AND SCREEP TOWARD CARD DATA OF A STARTER SCREEP AND SCREEP TOWARD SCREE						200	THE THE THE WOODNIEW WOODNIEW AND THE THE	VANTABLES
R	VARTABLE NAME	TYPE	VALUE MODE 2	ARRAY DIMENSION	INDEXED PARAMETER3	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
A 1 8 DI UNITO4 R C 33 C STARTER R A 15 DI STARTER C T TOTALS BET ED R C 31 Y PLOTSGL EL R C 31 Y PLOTSGL EL R C T TOTALS BET EL R C T TOTALS TOTALS EL R T TOTALS TOTALS EL R T TOTALS TOTALS EL R TOTALS TOTALS EL TOTALS TOTALS E TOTALS TOTALS EL TOTALS TOTALS	вих	æ	ပ					Cumulative number of aircraft brought up through a given year of a particular type or in a market or in all markets.
R	CARD	<	1	80	DI			Data on an input card.
R	CURVE	œ	ပ	33	ပ			Storage array for RPM or fuel consumption data to be plotted next.
ED R A 15 DI STARTER CURVES ED R C 31 Y TOTALS BET FL R C 31 Y PLOTSGL FL R C 31 Y PLOTSGL 4S R C BET BET 1S R C BET 1S R C BET	10	æ				STARTER		Not defined.
R	D2	24				STARTER		Not defined.
I C AMORTIZ R C 31 Y PLOTSGL R C 31 Y PLOTSGL R C BET R C BET R C BET R C BET	DUMPTY	æ	<	15	DI	STARTER	CURVES	Temporary designation for unused variables in common starter.
R C 31 Y PLOTSGL R C 31 Y PLOTSGL R C BET	DYEAR	н	ပ					Past year such that aircraft bought in that year are of retirement age in the current year.
R C 31 Y PLOTSGL R C BET R C BET R C BET R C BET	FBURNED	~	v			TOTALS		Fuel consumed in given year by aircraft of a given type; or cumulative fuel consumed up through a given year by aircraft of a particular type or in a market or in all markets.
R C BET BET BET R C BET	FBURNED	æ	ပ	31	>		PLOTSGL	Puel consumed in a year by aircraft of a specific type.
R C BET BET R C BET BET BET BET	PCTFUEL	~	ပ					Fraction of fuel burned in a given year in a specific market relative to total fuel burned in the year.
R C BET	FCTPOPL	~	ပ				BET	Praction of the number of aircraft in service in a given year in a specific market relative to total aircraft in service in the year.
R C	FCTRPMS	×	ပ				BET	Praction of the RPMs generated in a given year in a specific market relative to the total RPMs generated in the year.
	PCTSHIS	~	ပ				BET	Praction of the seat miles flown in a given year in a specific market relative to the total seat miles flown in the year.

Table A.2 (Continued)

VARIABLE NAME	TYPE1	VALUE MODE 2	ARRAY DIMENSION	INDEXED PARAMETER ³	COMPON	DE FINING ROUTINE	DESCRIPTION
FUELBRN	æ	2	10,31	Α,Υ	RESULTS	BET	Fuel consumed per aircraft of each type in each year.
FUELBRN	œ	၁	30,31	С, Ү	PLOTDAT	CURVES	Array for storing fuel consumption data for plotting aircraft market share curves.
GROWTH	œ	1	31	>		BET	Growth rate (in percent) of RPMs for each year.
1	-	၁				BET	Various uses: Do loop index, array index, etc.
IN	H	ပ			INDICES	BET	Index equal to number of existing aircraft types plus one.
II	H	ပ				BET	Array element index.
٦	H	၁				BET	Various uses: Do loop index, array index, etc.
I.P	æ	H	31	*	STATLIST	BET	Load factor for flights in a market for each year.
LIPETIM	æ	H	10	<	STATLIST	BET	Lifetime or nominal retirement age in years for each type of aircraft.
LOADPCT	~	ပ				BUYS	Computed load factor for filghts in a market in a year when seat miles supplied exceeds number needed to maintain input load factor (decimal).
TON	н	<				BET	Equal to 9, a logical unit number for the plotter.
LUN11	н	<				BET	Equal to 11, a logical unit number for the plotter.
MARKET	æ	ပ	31	*	MARKET	BET	Projected RPMs demanded in each year.
MAXFBRN	H	ນ				PLOTSGL	Maximum value of fuel consumption in hundreds of millions of barrels.
MAXRPMS	H	ပ		·		PLOTSGL	Maximum value of RPMs flown in hundreds of billions of miles.
MLIFET	os.	-	10	⋖	Kuus	BET	Lifetime or nominal retirement age in years for modified aircraft.
HODATA	A,R	H	7	Ð		BET	Temporary storage for seven data items pertaining to modified aircraft: MTYPE, MODYR, MSEATS, MSPC, MSPEED, MUTILIZ, MLIPET.

Table A.2 (Continued)

VARTABLE NAME	TYPE	VAL JE MODE ²	ARKAY DIMENSION	INDEXED PARAMETER ³	COMMON BLOCK	DE PINING ROUT INE	DESCRIPTION
MODYR	*	1	10	٧	MODS	BET	Year in which aircraft modification to begin.
HOURT	1	<				BET	Number indicator for each market.
HRKTYPE	A2	H	۳	¥	STARTER	BET	Alphanumeric name given each market.
MSEATS	~	H	01	<	SGOM	BET	Average number of seats in modified aircraft.
HSPC	æ	H	10	<	SOOM	BET	Average fuel consumption per seat mile for modified aircraft.
HSPEED	a s	ы	10	Ą	MODS	BET	Average speed in miles per hour for modified aircraft.
HTYPE	۷	4	10	<	MODS	BET	Alpha descriptor of aircraft type to be modified.
MUT IL 12	œ	H	10	<	Mode	BET	Utilization in hours per year for modified aircraft.
NAPE	<	ပ				BET	Alpha descriptor of aircraft type from MODATA(1).
NOBUYS	~	ı	10,46	Α,Υ	POP	BET	Number of aircraft of each type placed in service (bought) in each year.
NOBYS	~	ပ			TOTALS	BET	Number of aircraft of a npecific type bought in a given year.
NOCRVS		ပ			STARTER	CURVES	Number of curves to be plotted.
NOEXPLS	-	1			INDICES	BET	Mumber of exiting aircraft types in a market.
NOMODS	1	н				BET .	Number of aircraft types to be modified.
NOMBKS F	1	I,A		···		PLOTSGL	Number of tick morks on the fuel consumption axis (Y-axis) of plots.
NOMRKSR	1	I,A				PLOTSGL	Number of tick marks on the WPMs axis (Y-axis) of plots.
NONEW	,	H				BET	Number of new aircraft types in a market.
NORET I R	æ	P-4	10,46	A, Y	POP	BET	Number of aircraft retired from service of each type in each year.
NORTR	~	υ			TOTALS	BET	Number of aircraft of a given type retired in a given year.

Table A.2 (Continued)

VARTABLE NAME	TYPE ¹	VALUE MODE ²	ARRAY DIMENSION	INDEXED PARAMETER ³	COMMON	DE FINING ROUTINE	DESCRIPTION
our	1	၁			INDICES	BET	Index equal to total number of existing and new types of aircraft in a market.
PASS	H					AMORTIZ	Variable not used.
PERCENT	24	υ			STARTER	BET	RPM growth rate for a market in the base year.
PLOTS	V	H	10	⋖	STATLIST	BET	Flag indicating whether plots of fuel consumed and RPMs flown versus time are to be provided for an aircraft type.
PLT FUEL	æ	ပ	n	V.	STARTER	BET	Total fuel consumed by all aircraft in a market in 2005.
PLTRPMS	æ	၁	e	¥¥	STARTER	BET	Total revenue passenger miles flown by all aircraft in a market in 2005.
POPUL	~	o	10,31	Α,Υ	POP	BET	Number of aircraft in service of each type in each year.
POFULNO	æ	ပ			TOTALS	BET	Number of aircraft of a given type in service in a specific year.
RETIR	œ	ပ				BET	Cumulative number of aircraft retired up through a given year (f a particular type or in a market or in all markets.
RPM	œ	ပ	10,31	Α,Υ	RESULTS	BĘT	Revenue passenger statute miles flown per air- craft of each type in each year.
RPMDIFF	~	ပ				BUYS	Difference between RPMs demanded and those available in a market before aircraft buys in a given year.
RPMS	œ	ပ			TOTALS	BET	RPMs flown in a given year by aircraft of a given type; or cumulative RPMs flown up through a given year by aircraft of a particular type or in a market or in all markets.
RPMS	æ	ပ	31	¥		PLOTSGL	RPMs flown in a year by aircraft of a specific type.
RPMS	~	S	30,31	C,Y	PLOTDAT	CURVES	Array for storing RPMs flown for plotting market share curves.

Table A.2 (Continued)

SISTAN		VATTIE	ARRAY	TNDEXED	COMMON	DEFINING	
NAME	TYPE ¹	MODE 2	DIMENSION	PARAMETER 3		ROUTINE	DESCRIPTION
SEATMI	24	ວ	16,01	A,Y	RESULTS	BET	Number of seat miles flown per aircraft of each type for each year.
	œ	н	10	<	STATLIST	BET	Average number of seats per aircraft of each type.
	~	н	10	⋖	STATLIST	BET	Average fuel consumption per seat mile flown for each aircraft type.
SHRBUYS	œ	ပ	3,31	MA, Y	SHARES	SHARE	Number of aircraft placed in service in a market in each year.
SHRETIR	~	ပ	3,31	MA,Y	SHARES	SHARE	Number of aircraft retired from service in a market in each year.
SHRFUEL	~	ပ	3,31	MA, Y	SHARES	SHARE	Fuel consumption in a market in each year.
SHRPOPL	~	v	3,31	MA, Y	SHARES	SHARE	Number of aircraft in service in a market for each year.
SHRRPMS	æ	ပ	3,31	MA,Y	SHARES	SHARE	RPMs flown in a market in each year.
SHRSMIS	æ	ပ	3,31	MA, Y	SHARES	SHARE	Seat miles flown in a market in each year.
SMILES	~	ပ			TOTALS	BET	Seat miles flown in a given year by aircraft of a given type; or cumulative seat miles flown up through a given year by aircraft of a particular type or in a market or in all markets.
	æ	H	10	¥.	STATLIST	BET	Average block-to-block speed for each type of aircraft.
TOPFBRN	œ	I,C				PLOTSGL	Maximum value on the fuel consumption axis (Y-axis) of plots.
TOPRPMS	~	I,C				PLOTSGL	Maximum value on the RPMs axis (Y-axis) of plots.
	æ	v				BUYS	Total RPMs available in a market in a given year before aircraft buys in the year.
TOTLBUY	æ	ပ	31	>	ACCUMS	SHARE	Total number of airtraft bought in all markets for each year.
TOTLFLB	≈	ပ	31	*	ACCUMS	SHARE	Total fuel consumed in all markets in each year.

Table A.2 (Concluded)

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VARIABLE NAME	TYPE 1	VALUE MODE ²	ARRAY DIMENSION	INDEXED PARAMETER ³	COPPON	DEFINING ROUTINE	DESCRIPTION
TOTLMIS	æ	၁	31	Å	ACCUMS	SHARE	Total seat miles flown in all markets in each year.
TOTLPOP	e	ပ	31	*	ACCUMS	SHARE	Total number of aircraft in service for all markets in each year.
TOTLRPM	~	ပ	31	>	ACCUMS	SHARE	Total revenue passenger miles flown in all markets in each year.
TOTLRTR	6 4	ပ	31	> -	ACCUMS	SHARE	Total number of aircraft retired from service in all markets for each year.
TYPE		H	10	<	STATLIST	BET	Alpha name given to each aircraft type.
UTILIZ	æ	H	10	< <	STATLIST	BET	Utilization in hours per year per aircraft of each type.
x0	œ	4				PLOTSGL	X-coordinate starting value for plots.
xsc	e c.	ပ				PLOTSGL	X-coordinate scaling factor for plots.
YEAR	н	ပ				BET	Index denoting the calendar year.
YEARS	æ	ပ	31	ပ		PLOTSGL	Calendar year from 1975 through 2005.
YR	1	j.				BET	Index indicating the number of the year.
YRINTRO	~	H	10	∢	STATLIST	BET	Year of introduction for each aircraft type.
YSC	æ	ပ	31	>		PLOTSGL	Y-coordinate scaling factor.

POOTNOTES

ype of variable classification:	Value mode classifications:	Ţ
 A = Alphanumeric A2 = Double precision alphanumeric I = Integer R = Real 	 C = Value calculated in program I = Read from input file A = Value assigned in program 	

Indexed parameter for arrays:

A = Aircraft Type

MA = Market type

Y = Number of years

C = Number of curves

MD = Modification data

DI = Data items

Table A.3

VARIABLES
MODULE
ATREBAME MANIFACTURER MODULE VARIABLES
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VARIABLE NAME	TYPE ¹	VALUE MODE ²	ARRAY DIMENSION	ARRAY INDEXED 3 DIMENSION PARAMETER 3	COMMON	DEFINING ROUTINE	DESCRIPTION
ACCASHF	~	ပ	372	W.		CASHFLW	Accumulated monthly cash flow.
ACCINCO	~	ပ	372	WO.		REVENUE	Accumulated revenue (income) by month.
ACCMP	K	ပ	11,372	CH, MO		INTROR	Accumulated production costs by component and month.
ACCOST	«	ပ	372	МО		CASHFLW	Accumulated sum of RDT&E and production costs by month.
ACCUM	æ	ပ				PLANT	Sum of demand at end of each demand year.
ACRDTE	æ	O	5,372	см, мо		INTROR	Accumulated RDT&E costs by component and month.
Q	æ	ပ			COSTOT	ACCOST	Avionics development cost.
ADDE	«	ပ			COSTOT	ACCOST	Total airframe design and development engineer- ing cost, includes concept formulation and contract definition.
ADI	~	DSD, I				ACCOST	Avionics development cost.
AFSPA0	&	DSD				ACCOST	Airframe spares factor, production phase.
AGEO	æ	ပ			COSTOT	ACCOST	Operational ground support equipment cost.
AGE01	æ	DSD, I				ACCOST	Operational ground support equipment cost.
AGEP	~	ပ			COSTOT	ACCOST	Ground support equipment development cost.
AGEPI	~	DSD, I				ACCOST	Ground support equipment development cost.
AMPG	~	ပ			CSHFLO	ACCOST	Airframe manufacturing cost.
AP	œ	ပ			CUMOUT	ACCOST	Average airplane price for Q units.
API	æ	ပ				ACPRICE	Fractional form of average national price/cost index over period of interest.
ΑQ	~	ပ			COSTOT	ACCOST	Production total cost for NV airplanes.
AQFEE	e	ပ			COSTOT	ACCOST	Production phase contractor fee.
ASTOP	æ	۷				ACPRICE	Indicator for end of data.

VARIABLE NAME	TYPE.	VALUE MODE ²	ARRAY DIMENSION	INDEXED PARAMETER ³	COPIMON BLOCK	DEFINING ROUTINE	DESCRIPTION
AVGDIF	œ	ပ				PLANT	Months start of production to be offset to improve production schedule.
BBRKPT	ı	Ç				PLANT	Temporary save for "best" period breakpoint.
BIMCI	æ	ပ	31	*		INRR	Cash flow for eac year.
BRKPT	н	ပ				PLANT	Loop indicator year in demand schedule.
BSTOP	a c	∢				ACPRICE	Set equal to blank word.
ပ	~	ပ	37,5	CH, LC	COSTOT	ACCOST	Production cost factors by learning curve step.
ပ	e	<				ACPRICE	Constant to convert to millions (1.0E-6).
CACS	24	၁				ACCOST	Air conditioning system cost.
CAERO	~	ပ				ACCOST	Aerodynamic control system cost.
CAFCT	æ	ပ				Accost	Cumulative total airframe costs for Q units.
CAFCTI	æ	ပ				ACCOST	Cumulative total airframe costs for Q-1 units.
CAFFV	æ	ပ				ACCOST	Flight test vehicle airframe cost.
CAFO	æ	ပ				ACCOST	Production aircraft airframe cost.
CAFO	æ	ပ				COMPCOS	Airframe cost for each unit based on learning curve.
CAFOG	æ	ပ				COMPCOS	Airframe learning curve factor for Nth unit.
CAF01	24	ပ				COMPCOS	Airframe learning curve factor for N+1st unit.
CAFUCA	æ	ပ			CUMON	ACCOST	Cumulative average unit airframe cost for \emptyset units.
CANTIC	æ	ပ				ACCOST	Anti-icing cost.
CASHFLO	~	ပ	372	O M		CASHFLW	Cash flow by month.
CAVCT	æ	ပ				ACCOST	Cumulative total avionics costs for Q units.
CAVCTI	æ	ပ				ACCOST	Cumulative total avionics costs for Q-1 units.
CAVFV	æ	ပ				ACCOST	Flight test vehicle avionics cost.
CAVION	æ	ပ			CSHFLO	ACCOST	Avionics system cost.

Table A.3 (Continued)

R C COMPCOS R DSD, I COMPCOS R	VARÍABLE	TYPE.1	VALUE MODE 2	ARRAY	ARRAY INDEXED 3	COMON	DEFINING	DESCRIPTION
C COMPCOS C COMPCOS C C C C C C C C C C C C C C C C C C C	-							
R C COMPCOS R C COMPCOS R C C COMPCOS R DSD, I C C COMPCOS R DSD, I C C C C R DSD, I C C C C C C R DSD, I C C C C C C R DSD, I C C C C C C R DSD, I C C C C C C C R DSD, I C C C C C C C C R DSD, I C C C C C C C C C	AV0	œ	ပ				ACCOST	Production aircraft avionics cost,
R	0,40	œ	ပ				COMPCOS	Avionics cost for each unit based on learning curve.
R	AVOU	æ	ပ				COMPCOS	Autonics learning curve factor for Nth unit,
E R C ACCOST I R DSD, I ACCOST I B DSD, I ACCOST I R DSD, I A	AVO1	æ	ပ				COMPCOS	Avionics learning curve factor for N+1st unit.
R	AVONE	~	v				ACCOST	Avionics equipment cost.
R	AVONI	~	ပ				ACCOST	Avionics installation cost.
R C CUMMUT ACCOST R C ACCOST R DSD, I ACCOST	AVONT	~	v				ACCOST	Total avionics equipment and installation cost.
R C COSTOT ACCOST R C COSTOT ACCOST R C ACCOST R C ACCOST R C ACCOST R C ACCOST R DSD,1 ACCOST R ACCOST	AVUCA	~	Ü			CUMOUT	ACCOST	Cumulative average unit avionics cost for Q
B C COSTOT ACCOST C R C ACCOST C R C ACCOST B C ACCOST C R DSD, I ACCOST C R DSD, I ACCOST C R DSD, I ACCOST A R DSD, I ACCOST B DSD, I ACCOST B BSD, I ACCOST	BODY	~	<u> </u>				ACCOST	Aircraft fuselage cost.
D R C ACCOST C R C ACCOST R C ACCOST D C ACCOST D C ACCOST C R DSD, I ACCOST C BSD, I ACCOST		æ	ပ			COSTOT	ACCOST	Contract definition phase cost.
R C ACCOST R C ACCOST R DSD,1 ACCOST C R DSD,1 ACCOST C R DSD,1 ACCOST R C ACCOST R DSD,1 ACCOST R DSD,1 ACCOST B BSD,1 ACCOST	ELCAD	~	ပ				ACCOST	Electrical distribution rystem cost.
C R C ACCOST R C COSTOT ACCOST D R DSD, I ACCOST C R DSD, I ACCOST R C ACCOST R DSD, I ACCOST R DSD, I ACCOST B BSD, I ACCOST	<u> </u>	æ	ပ				ACCOST	Empennage cost.
R C ACCOST R DSD,1 ACCOST C R DSD,1 ACCOST C R DSD,1 ACCOST R C ACCOST N R DSD,1 ACCOST N R DSD,1 ACCOST D R DSD,1 ACCOST D R DSD,1 ACCOST R DSD,1 ACCOST R DSD,1 ACCOST	ENACC	æ	ပ				ACCOST	Engine accessories cost.
R DSD, I ACCOST D R DSD, I ACCOST C R DSD, I ACCOST N C ACCOST N BSD, I ACCOST N BSD, I ACCOST D R DSD, I ACCOST N BSD, I ACCOST R DSD, I ACCOST R DSD, I ACCOST	ENGS	æ	ပ				ACCOST	Airplane engines cost.
R DSD, I ACCOST C R DSD, I ACCOST K C ACCOST M R DSD, I ACCOST B B DSD, I ACCOST	<u> </u>	æ	ပ			COSTOT	ACCOST	Concept formulation phase cost.
R DSD, I ACCOST	FACS	~	DSD, I				ACCOST	Complexity factor air conditioning system.
C R DSD, I ACCOST N R DSD, I ACCOST N R DSD, I ACCOST DSD, I ACCOST ACCOST ACCOST ACCOST ACCOST ACCOST ACCOST	FAERO	~	DSD, I				ACCOST	Complexity factor aerodynamic control system.
R C ACCOST N R DSD, I ACCOST D R DSD, I ACCOST R DSD, I ACCOST R DSD, I ACCOST	FANTC	~	DSD, I				ACCOST	Complexity factor anti-icing system.
N R DSD, I ACCOST P R DSD, I ACCOST P R DSD, I ACCOST	FASSY	œ	ပ				ACCOST	Final assembly and chec'rout cost.
M R DSD, I ACCOST D R DSD, I ACCOST ACCOST ACCOST	FAVON	œ	DSD, I				ACCOST	Complexity factor avionics system.
D R DSD, I ACCOST ACCOST ACCOST	FBODY	×	DSD, I				ACCOST	Complexity factor aircraft fuselage.
R DSD, I ACCOST	FELCD	~	DSD, I				ACCOST	Complexity factor electrical distribution system.
	FEMP	œ	DSD, I				ACCOST	Complexity facto: empennage structure.

Table A.3 (Continued)

VAR IABLE NAME	TYPE ¹	VA LUE MODE ²	ARRAY DIMENSION	INDEXED PARAMETER ³	COMMON	DEFINING ROUTINE	DESCRIPTION
CFENAC	æ	n'asa				ACCOST	Complexity factor engine accessories.
CFENG	æ	DSD, I				ACCOST	Complexity factor airbreathing engines.
CFFUSY	æ	DSD, I				ACCOST	Complexity factor fuel system.
CFHINDL	~	DSD, I				ACCOST	Complexity factor for loading and handling.
CFHYCD	24	DSD, I				ACCOST	Complexity factor hyd:aulic system.
CFINST	œ	DSD, I				ACCOST	Complexity factor instrument system.
CFLG	æ	DSD, I				ACCOST	Complexity factor alighting gear system.
CFNAC	æ	DSD, I				ACCOST	Complexity factor engine nacelles.
CFPACC	ĸ	DSD, I				ACCOST	Complexity factor passenger accommodations.
CFPNCD	æ	DSD, I				ACCOST	Complexity factor pneumatic system.
CFPOW	~	DSD, I				ACCOST	Complexity factor auxiliary power system.
CFTREV	æ	DSD, I				ACCOST	Complexity factor thrust reverser.
CFUSYS	~	ပ				ACCOST	Fuel system cost.
CFWING	~	nsd, i				ACCOST	Complexity factor wing structure,
CHANDI.	æ	v				ACCOST	Load and handling system cost.
СНУСАБ	~	၁				ACCOST	Hydraulic system cost.
CINST	~	ပ				ACCOST	Instrument system cost.
CINSTE	~	ပ				ACCOST	Instrument equipment cost.
CINSTI	~	ပ				ACCOST	Instrument installation cost,
CLG	24	ပ				ACCOST	Alighting gear cost,
CNACEL	~	ပ				ACCOST	Engine nacelles cost,
COMENT	æ	1-4	∞	DI		ACPRICE	Input card comments.
COMPCST	œ	ပ	11,372	см, мо	COMPCST	COMPCOS	Summary array of production costs by component and month.
CONFIG	×	DSD, I				ACCOST	Engineering complexity factor.

Table A.3 (Continued)

VARIABLE	TYPE.	VALUE MODE ²	ABZAY DIMENSION	INDEZED PARAMETER ³	COPPYON BLOCK	DEPINING FOUTINE	DESCRIPTION
COST	ă	၁	37.2	Q.		CASHPLW	Sum of RDT&E and production costs each month.
CFACCO	24	v				ACCOST	Passenger accommodations and furnishing cost.
CPCT	~	ပ				ACCOST	Cumulative total propulaton costs for Q units.
CPCTI	œ	ပ				ACCOST	Cumulative total propulsion costs for Q-1 units.
CPFC	æ	ن د				ACCOST	Plight test vehicle propulsion system cost,
CPNCAD	e 4	v				ACCOST	Pneumatic system cost.
CPO	æ	ပ				ACCUST	Production aircraft propulsion system cost.
O.B.O	est.	v					Propulsion cost for each unit based on learning curve.
CP00	er.	၁					Propulsion learning curve factor for Wth unit.
CP01	e ct	υ					Propulsion learning curve factor for Wist unit.
CPOWER	64	ပ				ACCOST	Auxiliary power system cost.
CPUCA	œ4.	ပ			C:MOUT	ACCOST	Cummulative average unit propulsion cost for Q units.
CSTRUC	αĸ	υ				ACCOST	Assembled airplane cost.
d:	~	၁				ACCOST .	Airplane engine unit cost.
CTJI	œ.	DSD, I		-		A_COST	Input value for airplane engine unit cost.
CTREVS	~	ပ				ACCOST	Thrust reverser cost.
5	α	IJ				ACCOST	Total aircraft manufacturing cost.
CWING	as.	U				I ACCOST	Wing cost.
PC.F	œ	၁	31	>		IHRR	Discounted cash flow for each year.
1200	œ	ပ			COSTOT	ACCOST	Airframe design and development engineering cost.
DEITHPL	1	υ				ROTE	Last month before delivery month.
DELAY	I	٧	5	8		KOTE	Delay before RDTE component cost starts (5 factors),

Table A.3 (Continued)

VAR IABLE NAME	TYPE ¹	VALUE MODE ²	ARRAY DIMENSION	INDEXED PARAMETER	COMMON BLOCK	DEFINING RUUTINE	DESCRIPTION
DELIVER	ı	o o	0007	NA	DELIVER	PLANT	Month in which each unit will be delivered (same as PRODUCT).
DELTAP	~	ပ				INPLANT	Increment for aircraft price.
DELTAR	~	۷				INRR	Change in rate for present value calculations.
DELSCHL	н	ပ	396	9		PLANT	Cumulative number of units delivered each month (same as PRDSCHL).
DEMAND	~	ပ	31	*	DEMAND	INPLANT	No. of one new aircraft type demanded each year,
DISCREP	-	ပ	29	*		PLANT	Discrepancy between production possible and demanded.
Sa	øs.	υ			costor	ACCOST	Research, development, test and evaluation support.
EAIRPP	æ	၁				ACPRICE	Estimated airframe price.
EAIRPR	e £	၁				ACPRICE	Estimated airplane price.
EDEVC	œ	ပ				ACPRICE	Estimated sirplane development cost.
EENCPR	æ	o -				ALTRICE	Estimated engines total price.
EN	æ	r			-	ACPRICE	Number of main engines
EN	æ	DSD, I				ACCOST	Number of main engines.
END1		၁				PLANT	Last month in production schedule for period 1.
END1	н					COMPCOS	Not used.
END2	ı	၁				PLANT	Last month in production schedule for period 2.
ENSPAO	æ	DSD, I			CSHPLO	ACCOST	Main engine spares factor, production phase.
ENSPAR	æ	DSD, I				ACCOST	Main engine spares factor, RDT&E phase.
EPRICE	æ	0			PRICED	ACPRICE	Estimated airplane market place price.
ESEPRI	~	ນ	m	∀		ACPRICE	Estimated airplane price by seat cost, millions
					·		

Table A.3 (Continued)

VAR I ABLE NAME	TYPE ¹	VALUE MODE ²	ARRAY DIMENSION	INDEXED 3	COMMON	DEFINING ROUTINE	DESCRIPTION
FAC	œ	ပ			costor	ACCOST	Production facilities cost.
PACI	œ	DSD, I				ACCOST	Input value of production facilities cost.
FEE	æ	DSD,1			CUMOUT	ACCOST	Manufacturer fee factor.
FEE	e	-				ACPRICE	Not used.
PIRSTPR	н	ပ				PLANT	No. of years in first period.
FP1	н	ပ				PLANT	Pointer to first year of period 2.
FP ROD1	œ	ပ				PLANT	Actual monthly production rate for period 1.
FPROD2	e	ပ				PLANT	Actual monthly production rate for period 2.
PTO	e	၁			COSTOT	ACCOST	Flight test operation cost.
FT01	œ	DSD, I				ACCOST	Input value for flight test operation cost.
FTS	æ	ပ			COSTOT	ACCOST	Flight test aircraft spares cost.
2	~	ပ			COSTOT	ACCOST	Flight test vehicles cost.
FVCT	e	ပ			CUMOUT	ACCOST	Cumulative total airplane costs for Q units.
FVCTI	æ	ပ				ACCOST	Cumulative total airplane costs for Q-1 units.
FVSPAR	6 4	DSD, I				ACCOST	Flight test vehicle spares.
PVUC	a	ပ			CUMOUT	ACCOST	Unit airplane cost of Q-th unit.
FVUCA	œ	ပ			CUMOUT	ACCOST	Cumulative average unit airplane cost for \boldsymbol{Q} units.
crs	<u>م</u>	υ			CUMOUT	ACCOST	Ground test vehicle spares cost.
GTSPAR	a c	DSD, I				ACCOST	Ground test vehicle spares factor.
GTV	æ	၁			COSTOT	ACCOST	Ground test vehicles cost.
Ηb	~	1				ACPKICE	Engine design shaft horsepower.
	-	17				INPLANT	Loop index (multiple uses).
ΥI	H	ပ	6	DI		ACPRICE	Indicator used in estimating airplane cost.
LACCUM	-	ပ				PLANT	Rounded (up by .67) sum of units demanded.

Table A.3 (Continued)

VARIABLE NAME	TYPE ¹	VALUE MODE ²	ARRAY DIMENSION	INDEXED PARAMETER 3	COPPYON BLOCK	DEFINING ROUTINE	DESCRIPTION
IAIRPL	I	put				ACPRICE	Indicator for airplane type. IAIRPL-1 for conventional jet transports. IAIRPL-2 for small jet transports. IAIRPL-3 for wide body jet transports. IAIRPL-4 for turbo-prop transports. IAIRPL-5 for general aviation types. IAIRPL-6 for supersonic transports.
18	н	17				PLANT	Loop index - starts at 2.
ICNT	H	ပ				INRR	Counter to find every 10th cycle.
ICONPG	H	DSD, I				ACCOST	Indicator for aircraft type, (6 = subsonic production, 7 = prototype, 8 = supersonic production).
ICUM	H	ပ			CUMOUT	ACCOST	Indicator for cumulative quantity.
IDATA	-	DSD, 1				ACCOST	Not used.
IDIFF	H	ပ				PLANT	Difference between last month of each demand year and month last unit scheduled for production.
IENGS	H	H				ACPRICE	Indicator for type of engines. IENGS=1 for turbojet and turbofan. IENGS=2 for turboprop. IENGS=3 for reciprocating. IENGS=4 for airbreathing.
	-	17				ACPRICE	Loop index.
	H	ပ				INRR	Last value of loop index.
IMAX1	н	၁				PLANT	Temporary to find largest differences in periodl.
IMAX2	н	ပ				PLANT	Temporary to find largest differences in period 2.
IMINI	H	ပ				PLANT	Temporary to find largest differences in periodi,
IMIN2	H	ပ				PLANT	Temporary to find largest differences in period 2.

Table 4.3 (Continued)

VARIABLE TYPE ¹ MATH						
	VALUE MODE ²	ARRAY DIMENSION	INDEXED 3	COMMON	DEFINING ROUTINE	DESCRIPTION
	o .			STARTUP	INPLANT	Month in which demand begins (years since 1974 x 12).
IN	ပ				RDTE	Starting month for each RDTE component.
INCOME	ပ	372	Q.		REVENUE	Total revenue (income) each separate month.
I SdOI	DSD, I				ACCOST	Indicator for type operational program, 1 = commercial airline, 0 = other.
IP I	ပ			PRINT	INPLANT	Print flag for monthly cost, income, and cash-flow tables in INTROR (0-print, 1-no print).
I POWER I	DSD, I				ACCOST	Not used.
1PROD I	DSD, I			CUMOUT	ACCOST	Indicator for prototype or production tooling;
						1 = production, U = prototype.
I bi	DSD, I	33	¥.	CUMOUT	ACCOST	Indicator for aircraft quantity matrix.
IR	171				INTROR	Pointer to month within loops,
I SI	၁				INRR	Starting value of loop index.
IT R	ပ				ACCOST	Initial flight crew training cost for NV airplanes.
I HAI	II				CASHFLW	Component loop index.
ITHPL	LI				PLANT	Unit loop index pointer.
I TOTAL I	ပ			TOTAL	PLANT	Number of units in period 1.
I TOTAL1 I	ပ				PLANT	Upward rounded (by .67) number of whole aircraft demanded in period 1.
ITOTAL2 I	ပ				PLANT	Upward rounded (by .67) number of whole aircraft demanded in period 2.
IV R	o -				ACCOST	Total aircraft production costs for NV airplanes
IWLC 1	DSD, I				ACCOST	Indicator for landing gear component breakdown.
IYEAR I	υ —				PLANT	Loop index for each year of demand.
IYR	c				INPLANT	Indicator for first year of demand (since 1974).

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Table A.3 (Continued)

						I	
VARIABLE NAME	TYPE ¹	VALUE MODE ²	ARRAY DIMENSION	INDEXED PARAMETER ³	COMMON	DEFINING ROUTINE	DESCRIPTION
T.	I	LI				INPLANT	Loop index.
JMATHPL	H	ပ				PLANT	Offset pointer to month of production for each unit.
×	~	၁				INRR	Temporary for accumulated discounted cash flow.
KICKOFP	H	ပ	29	¥		PLANT	Startup date of production for each period.
KK	æ	ပ				INRR	Temporary for accumulated discounted cash flow.
KKK	e 4	ပ				INRR	Temporary for accumulated discounted cash flow.
LB	H	၁				PLANT	Loop index.
LEARN	~	DSD, I			сѕнъго	ACCOST	Airframe learning curve.
LEARNA	α	DSD, I			CSHFLO	ACCOST	Avionics learning curve.
LEARNP	24	DSD, I			CSHFLO	ACCOST	Engine learning curve.
ĽN	н	v				RDTE	Months before production that RDTE component cost starts.
LTIME	-	DSD	372	MO		PLANT	Lead time in months on delivery from order times.
MACH	æ	DSD, I			CUMOUT	ACCOST	Maximum design flight mach number for engines.
MAXP	H	၁			MAXP	PLANT	Maximum monthly production rate.
MEQ	~	၁			COSTOT	ACCOST	Miscellaneous equipment cost.
MIN	ı	٧				PLANT	Not used,
HINIMAX	н	၁				PLANT	Largest difference (in absolute value) for each subdivision.
MVTH	н	17				CASHFLW	Month loop index.
MNTHPAY	н	o				REVENUE	Monthly payments between order and delivery.
z	H	rı				ACCOST	Loop index.
NCREW	×	DSD, I				ACCOST	Number in flight crew per airplane.

Table A.3 (Continued)

VARIABLE NAME	TYPE ¹	VALUE MODE ²	AKRAY DIMENSION	INDEXED PARAMETER 3	сомном Вгоск	Depining Routine	DESCRIPTION
NDATA	1	nsp, i			COSTOT	ACCOST	Number of positions (from 1 to 5) on learning curve.
NFV	æ	DSD, I			costor	ACCOST	Number flight test vehicles.
NG	e	DSD, I			COSTOT	ACCOST	Number of ground test vehicles.
NI,	H	ပ				INRR	Calculated last value of loop index.
NOCOMP	H	۷				COMPCOS	Number of production cost components.
NOCON	æ	DSD, I				ACCOST	Number of concept formulation contractors,
NOCON1	æ	DSD, I				ACCOST	Number of contract definition contractors.
NOENC	œ	DSD, I				ACCOST	Number of concept formulation engineers.
N. ENG1	æ	DSD, I				ACCOST	Number of contract definitions engineers.
NOYRS	æ	DSD, I				ACCOST	Number of years for concept formulation.
NOYRS1	æ	DSD, I				ACCOST	Number of years for contract definitions.
NPL	¤	ပ				ACCOST	Total number flight crew personnel to be trained.
NTRY	H	Ü				PLANT	Program control index.
N	œ	DSD, I, C			COSTOT	ACCOST	Number of operational vehicles.
NVEII	A \$	DSD, I	٠,	3	COSTOT	ACCOST	Number of vehicles for which costs to be corputed.
AHAN	æ	ပ			costor	ACCOST	Total number flight test and operational vehicles.
KVHF	1	H				ACPRICE	Total number flight test & operational vehicles

Table A.3 (Continued)

ORDER I C 4000 NA ORDER PLANT Month in which each unit is or costron. OSTTHPL I C C COSTOT COSTOT ACCOST Operational vehicles spares condenses. OSA R C C C COSTOT ACCOST Production alframe spares. OSPO R C C C C C COSTOT ACCOST Production engine spares. OSPO R C C C C COSTOT COMPCOS Engine spares learning cost fast out for the spares. OSPO R C C C COSTOT COMPCOS Engine spares learning cost fast out for for fast for for fast for for for fast fast for fast fast for fast fast fast fast fast fast fast fast	VAR I ABLE NAME	TYPE ¹	VALUE MODE ²	ARRAY DIMENSION	INDEXED Parameter ³	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
4PL 1 C REVENUE R C ACCOST ACCOST R C ACCOST ACCOST R C ACCOST ACCOST R C ACCOST COMPCOS R C ACCOST ACCOST R C ACCOST ACCOST B C	ORDER	-	၁	4000	NA	ORDER	PLANT	Month in which each unit is ordered.
R	ORITHPL	-	ບ				REVENUE	Next month after order month.
R	00	æ	ບ			COSTOT	ACCOST	Operational vehicles spares cost.
R) vso	pd.	ပ				ACCOST	Production airframe spares.
R	OSP	æ	ပ				ACCOST	Production engine spares.
R	OSPO	as	ပ				COMPCOS	Engine spares learning cost factor for Nth unit.
R	0SP1	ρť	ပ				COMPCOS	Engine spares learning cost factor for N+1st unit,
I	Þ	œ	ပ			COSTOT	ACCOST	Training equipment cost.
1	OUT	1	υ				RDTE	Ending month for each RUTE component.
B C COSTOT ACCOST D I C ACCOST D I A S CM LIFETIM INPLANT D I A S CM ACCOST B I A S CM ACCOST B I I ACCOST ACCOST B I I ACPRICE INPLANT B C 20 PE PRODIDS COMPCOS B C A PRODICT PLANT CT I C 4000 NA PRODICT PLANT	00	œ	ပ			COSTOT	ACCOST	Operational vehicles costs.
B I C CM LIFETIM INPLANT B I A S CM RDTE B I,A S CM RDTE B I,A N ACCOST B I,A N ACCOST B I I ACPRICE INPLANT INPLANT INPLANT B C COMPCOS C COMPCOS R C COMPCOS C COMPCOS C COMPCOS C COMPCOS C C C C C C C C C C C C C C C C C C C C C C C C C C C C C	PDTJ	e	ပ			COSTOT	ACC0ST	Propulsion development cost turbo-jet engines.
RIOD I C CM LIFETIM INPLANT RIOD I A 5 CM RDTE R I,A P ACCOST ACCOST R I ACCOST ACPRICE R C 20 PE INPLANT DDIDS R A INPLANT IC C COMPCOS COMPCOS ICEO R C COMPCOS DDUCT I C C A000 NA PRODUCT PLANT	PDTJI	œ	DSD, I				ACCOST	Input value for propulsion development cost turbo-jet engines.
RIOD I A 5 CM RDTE R I,A 1 ACCOST R I,A 1 ACPRICE NDIDS R C 20 PE INPLANT I R A INPLANT COMPCOS I R C COMPCOS COMPCOS ICEO R C COMPCOS INPLANT DOUCT I C 4000 NA PRODUCT PLANT	PERIOD	1	၁			LIFETIM	INPLANT	No. of years new aircraft is demanded.
R DSD, I ACCOST ACCOST R I, A	PER 10D	1	<	2	5		RDTE	Duration of each RDTE cost component.
R	PN	œ	DSD, I				ACCOST	Total number of passengers.
R	N.	~	Y'I				ACPRICE	Total passenger capacity.
DDIDS R C 20 PE INPLANT DDIDS R C COMPCOS I R C COSTPR DDUCT I C 4000 NA PRODUCT PLANT	PO	~	1				INPLANT	Base market price of aircraft type.
DIDS R A PRODIDS COMPCOS CEO R C COSTPR DUCT I C 4000 NA PRODUCT PLANT	PP	~	၁	20	PE		INPLANT	Array of aircraft price estimates used.
CEO R C PRICEO INPLANT DUCT I C 4000 NA PRODUCT PLANT	PRODIDS	œ	<			PRODIDS	COMPCOS	Array of alphabetic titles for production cost factors.
R C PRICEO INPLANT I C 4000 NA PRODUCT PLANT	PRI	œ	ပ				COSTPR	Indicator for vehicle type.
I C 4000 NA PRODUCT PLANT	PRICEO	~	ပ			PRICEO	INPLANT	Price of aircraft.
	PRODUCT	H	ပ	4000	N.	PRODUCT	PLANT	Month in which each unit will be produced.

Table A.3 (Continued)

PROD1 I PROD2 I PROPU R		DIMENSION	INDEXED PARAMETER ³	BLOCK	DEFINING ROUTINE	DESCRIPTION
PROD I R PROPU R PROSCHL I	၁				PLANT	Upward rounded (by .67) monthly production rate in first period.
PROPU R PROSCHL I	ပ				PLANT	Upward rounded (by .67) monthly production rate in first period.
PROSCHL I	ပ			CSHFLO	ACCOST	Total propulsion system cost.
	ပ	396	1 40	PRDSCHL	PLANT	Cumulative number of units produced each month.
PV	ပ	31	*		INRR	Present value factor.
8 4	ပ				ACCOST	Total number of vehicles manufactured.
es es	υ				INRR	Rate of return difference,
RATE R D	DSD, I			СОМООТ	ACCOST	Vehicle production rate, number/month.
RDFEE R	ပ			COSTOT	ACCOST	Contractor fee, RDI&E phase.
RDTE R	ပ				ACCOST	Research, development, testing and engineering cost.
RDTECHT R	၁	5,372	CH, HO		RDTE	Monthly breakdown of RDT&E costs by component.
RDTELBL R	<	\$	5		RDTE	Alphabetic descriptor of RDT&E cost components.
R L	DSD, I				ACCOST	Engineering labor rate.
oc oc	ပ	20	PE		INPLANT	Array of rate of return values based on aircraft price.
22 22 22	ပ				INRR	Rate of return difference.
RT R	DSD, I				ACCOST	Tooling labor rate.
RRR	ပ				INRR	Rate of return difference.
SC ×	ပ			симоит	ACCOST	Total manufacturing sustaining costs for Q
S S	ပ			COSTOT	ACCOST	units. Sustaining engineering costs.
SEO R	ပ				COMPCOS	Sustaining engineering cost factor for Nth unit,

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Table A.3 (Continued)

		-		INDEXED		DEFINING	
	TYPE ¹ H	MODE ²	DIMENSION	Parameter ³		ROUTINE	DESCRIPTION
	~	ပ				COMPCOS	Sustaining engineering cost fact for WHIst unit.
SPARES	<u>×</u>	ပ				COMPCOS	Total spares cost based on learning curve (same as 0S).
ST		ပ			COSTOT	ACCOST	Sustaining tooling cost.
STO		ပ				COMPCOS	Tooling and special equipment learning cost factor for Nth unit.
ST1	~	ပ				COMPCOS	Tooling and special equipment learning cost factor for N+1st unit.
SUBSYS	~	Ü	·		COSTOT	ACCOST	Subsystem development cost.
SUBSYI	<u>~</u>	DSD, I				ACCOST	Input value for subsystem development cost.
SUM		υ				CASHFLW	Used for totaling NDT&E and production costs.
SUM	<u> </u>	ပ				INRR	Temporary sum of discounted cash flow.
SUM	<u> </u>	ပ				REVENUE	Temporary to accumulate sum by month.
SUM		ပ				INTROR	Temporary to accumulate sum by month.
SUM1		၁				CASHFLW	Used for totaling RDT&E costs.
SUM2		၁				CASHFLW	Used for totaling production costs.
SUMDIF		ပ				ACCOST	Sum of differences for each period subdivision.
		H				ACCOST	Thrust per engine at sea level.
Too	<u> </u>	၁			costor	ACCOST	Production aircraft technical data cost,
TOP	<u></u>	Ü			costor	ACCOST	RDT&E technical data cost.
TITLE			. 01	DI		COSTPR	Input title for printouts.
THIC		Ü			симоит	ACCOST	Total of all manufacturing costs for Q units.
TOOLC	<u> </u>	DSD, I				ACCOST	Complexity factor tooling.
TOTAL		ပ				PLANT	Actual total number of aircraft demanded in both periods.
		-					

Table A.3 (Continued)

VARIABLE NAME	TYPE ¹	VALUE MODE ²	ARRAY DIMENSION	INDEXED PARAMETER ³	COMYON	DEFINING KOUTINE	DESCRIPTION
TOTAL1	æ	၁				PLANT	Actual number of craft demanded in 1st period.
TOTAL2	24	ပ				PLANT	Actual number of craft demanded in 2nd period.
TOVERW	~	ပ				ACCOST	Total engine thrust over airplane takeoff gross weight.
TPEREN	æ	ပ				ACCOST	Thrust in pounds per engine,
TRDTE	a£	υ			COSTOT	ACCOST	Total research, development, tooling & engineering cost.
TRDTEC	æ	ပ	\$	3		ACCOST	Array of RDISE cost factors.
TRI	24	ပ			costor	ACCOST	Initial transportation cost.
TS	н	ပ			STARTUP	INPLANT	Same as IMNTH in INPLANT. Month demand for aircraft type starts.
TST	æ	Ĵ			COSTOT	ACCOST	Tooling and special equipment cost.
тпске	*	၁	١0	CM		ACCOST	Array of production cost factors.
TTS	=	O			TTS	PLANT	Modified start of production month.
UMC	æ	၁				COMPCOS	Operational vehicles cost (same as UV).
VHAX	æ	ບ				ACCOST	Maximum vehicle speed, knots.
S	~	ပ			симоит	ACCOST	Vehicle AMPR weight.
WACS	œ	DSD, I				ACCOST	Air conditioning system weight.
WAERO	æ	DSD, I				ACCOST	Aerodynamic control system weight.
WAIRFR	œ	ပ				ACPRICE	Airframe weight.
WANTIC	~	n.asa				ACCOST	Anti-icing system weight.
WAVION	æ	DSD, I				ACCOST	Avionics system weight.
WAVIOT	æ	ပ				ACCOST	Total avionics and instrument weight.
WBODY	æ	DSD, I				ACCOST	Fuselage weight.
AE.	æ	ပ				ACCOST	Aircraft empty weight.

Table A.3 (Continued)

VARIABLE	TYPE	VALUE MODE ²	ARRAY DIMENSION	INDEXED PARAMETER ³	COMMON	DEFINING ROUTINE	DESCRIPTION:
	æ	I				ACPRICE	Aircraft empty weight.
WELCAD	æ	DSD, I				Accost	Electric power conversion and distribution system weight.
	æ	DSD, I				ACCOST	Empennage weight.
WENACC	æ	DSD, I				ACCOST	Engine accessories weight.
WENGS	œ	DSD, I				ACCOST	Engines total weight.
WENGS	~	н				ACPRICE	Engines total weight.
WFUSYS	œ	DSD, I				ACCOST	Fuel system weight.
WFUIOT	œ	DSD, I				ACCOST	Total fuel weight.
WCROSS	œ	DSD, I			CUMOUT	ACCOST	Aircraft gross take-off weight (= WG = WTO).
WHANDL	æ	DSD, I				ACCOST	Load and handling system weight.
WHYCAD	œ	DSD, I				ACCOST	Hydraulic power conversion and distribution system weight.
HINST	~	DSD, I				ACCOST	Instrument system weight.
	æ	DSD, I				ACCOST	Alighting gear system weight.
WLGCON	«	DSD, I				ACCOST	Alighting gear controls weight.
WLCSTR	æ	DSD, I				ACCOST	Alighting gear structure weight.
WLGIRS	æ	DSD, I				ACCOST	Tire weight.
WLCW4L	~	DSD, I				ACC0ST	Wheels and brake weight,
WNACEL	~	DSD, I				ACCOST	Engine nacet: "might,
WPACCO	~	DSD, I				ACCOST	Passenge tions (and equipment) weight.
WPAYI.	æ	DSD, I				ACCOST	Payload to , iit.
WPNCAD	~	DSD, I				ACCOST	Pneumatic p. r and distribution system weight.
WPOWER	*	DSD, I				ACCOST	Auxiliary power system weight.
WPPROV	æ	၁				ACCOST	Crew size related subsystem development cost factor.

VARTABLE	TYPE ¹	VALUE MODE ²	ARRAY DIMENSION	INDEXED 3	COMMON	DEFINING ROUTINE	DESCRIPTION
WTREVS	×	DED, I				ACCOST	Thrust reverser weight.
WWING	×	DSD, I				ACCOST	Wing weight.
SAVD	æ	DSD, I				ACCOST	Avionics development factor.
XFASSY	æ	DSD, I			CSHNLO	ACCOST	Final assembly-check out cost fraction.
XNEV	œ	DSD, I				ACCOST	Miscellaneous equipment development factor.
YEAR	-	17				INPLANT	Loop index.
	H	rı				INPLANT	Loop index.
	æ	ပ				ACCOST	Airframe production learning curve cost factor.
	~	၁				ACCOST	Avionics production learning curve cost factor.
ZAF	~	၁				COMPCOS	Airframe learning curve factor,
ZAV	~	ပ				COMPCOS	Avionics learning curve factor.
ZETA	~	ပ				ACCOST	Airframe learning curve exponent.
ZETAA	~	ပ				ACCOST	Avionics learning curve exponent.
ZETAP	~	၁				ACCOST	Engine learning curve exponent.
	~	ပ				ACCOST	Engine production learning curve cost factor.

FOOTNOTES

1. 18.4 2.

Indexed parameter for arrays:	Y = Number of Years DI = Data items CM = Component number MO = Number of months NA = Number of aircraft PE = Price estimates LC = Learning curve step
Value mode classifications:	C = Value calculated in program I = Read from input file DSD = Data statement definition A = Value assigned in program LI = Loop index
e of variable classification:	- Integer - Real

Table A.4
DEFINITION OF AIR CARRIER MODULE VARIABLES

DESCRIPTION	Costs of added flight crew (over 2), dollars.	Flight operations expense (less rentals) in dollars per block hour.	Maintenance expense for flight equipment in dollars per block hour.	Flight operations expense for rentals in dollars per block bour,	Cost per stewardess per block hour, dollars.	Food expense in dollars per passenger per block hour.	Cost of other passenger in-flight expenses in dollars per passenger-mile.	Aircraft line servicing expense in dollars per departure.	Aircraft control servicing expense in dollars per block hour,	Landing fee per departure in dollars.	Passenger traffic servicing expense in dollars per passenger.	Baggage traffic servicing expense in dollars per ton.	Cargo traffic servicing expense in dollars per ton.	Reservation and sales expense per passenger in dollars.	Reservation and sales expense per passenger-mile in dollars.	Reservation and sales expense for property in dollars per ton-mile.
DEPINING ROUTINE	DIRECT	INDIR	INDIR	INDIR	INDIR	INDIR	INDIR	INDIR	1MD IR	INDIR	INDIR	INDIR	INDIR	INDIR	INDIR	INDIR
COMPON																
INDEXED PARAMETER ³																
ARRAY DIMENSIOU																
VALUE KODE ²	1	H	H	.	H	н	н	н	H	н	H	н	put	H	н	I
TYPE1	æ	os.	×	æ	æ	øs .	æ	od.	as.	æ	ΩS	ps;	os.	os.	os.	æ
VARTABLE NAME	ADDC	A11	A12	AI4	AI5	A16	A17	A18	419	A110	A111	A112	A112A	A113	A114	AI15

3

-							
VAR TABLE NAME	TYPE ¹	VALUE HODE ²	ARRAY DIMENSION	INDEXED PARAMETER ³	COMPON	DEFINING ROUTINE	DESCRIPTION
	ost.	1				INDIR	Auvertising and publicity expense per passenger-mile in dollars.
	os.	=				INDIR	Advertising and publicity expense for property in dollars per ton-mile.
	cal d	H ,				INDIR	Maintenance expense for ground property and equipment per departure in dollars.
	×	-	•			INDIR	Expense for depreciation and amortization of general ground property and equipment in dollars per departure.
	ad s	н,				INDIR	Maintenance equipment depreciation factor,
	ء ک	- (INDIR	General and administrative expense factor,
	*	<u></u>				TAX	Yearly total earnings before taxes (where there is a lose), dollars.
		1/V				DIRECT/ INDIR	Air maneuver time, hours,
	A	<	25,100	Λ,Υ	NI.	INPUTS	Annual revenue, dollars.
	a 6	H (INDIR	Baggage per passenger in pounds.
	× 6	، ن	12	ST		DIRECT	Block fuel, pounds.
	× ,	۰	12	ST		DIRECT	Block speed, mph.
	× ,	 ပ	12	ST		DIRECT	Block time, hours.
	~	v	25,100	Y, A	N.	DEPSUB	Book value of afreraft in snerific was solder
	~	ပ	17	ST		INDIR	Plying operations (less rentals) expense,
	~	ပ	17	ST		ATUNI	COLLAR &
	~	-	17	ST			Don't of first equipment expense, dollars,
	æ	ပ	11	ST			remains of fight equipment, dollars.
	<u>~</u>	ပ	17	ST			Stewardess expense (first class), dollars. Stewardess expense (coach). dollars.
-	-	1					יייייייייי ביני בילביים (רספרוו) ממזואופי

.
Table A.4 (Continued)

DESCRIPTION		orewardess expense (total), dollars.	Food expense (first class), dollars.	Pood expense (coach), dollars.	Passenger in flight food expense (total),	Other passenger in-flight expenses (first class),	Other passenger in-flight expenses (coach),	Other passenger in-flight expenses (total), dollars.	Aircraft line servicing expense Apliano	Aircraft control servicing expenses	Landing fees, dollars	Passenger traffic servicing expense (first class),	traffic servicing expense (coach),	Baggage traffic servicing expense (first class), dollars.	Baggage traffic servicing expense (coach),	Traffic servicing expense (passengers and baggage), dollars.		Reservation and sales expense (first class),	
DEFINING	\dagger												Passenger dollars.						10151105
COMMON DEF	STONE		NIUNI	INDIR	INDIR	INDIR	INDIR	INDIR	INDIR	INDIR	INDIR	INDIR	INDIR	INDIR	INDIR	INDIR	INDIR	INDIR	_
INDEXED PARAMETER ³	ST	£	ī	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	
ARRAY DIMENSION	12	17	; ;	71	17	17	17	17	17	17	17	17	71	17	17	17	17	17	_
VALUE MODE 2	0	ن	, ,	,	v	ပ	Ü	U	ပ	v	ပ	ပ	υ	ပ	ပ	o o	ပ	ပ	_
TYPE 1	×	~	· ·	¥	ec	~	œ	œ	æ	æ	æ	œ	œ	æ	~	æ	~	œ	,
VAR IABLE NAME	83	63	015	010		C12	c13	C14	C15	616	Ci7	618	619	C20	C21	C22	.c23	C24	

		INDIR	Reservation and sales expense (passenger total), dollars.
rs ts		INDIR	Keservation and sales expense (property), dollars, Advertising and publicity expense (first class), dollars.
ST	H.	INDIR	Advertising and publicity expense (coach), dollars.
ST		INDIR	Advertising and publicity expense (passenger total), dollars.
ST	<u></u>	INDIR	Advertising and publicity expense (property), dollars.
ST		INDIR	Maintenance expense (ground property and equipment), dollars.
ST	TS	INDIR	Depreclated general ground property and equipment, dollars.
ST		INDIR	Depreciation of maintenance equipment, dollars.
ST	Ts	INDIR	General and administrative expense, dollars.
ST	L		Total indirect operating expense, dollars.
		DIRECT/ INDIR	Total indirect operating expense, dollars.
ST		DIRECT/ INDIR	Cost per aircraft wile, dollars.
ST	ST	DIRECT/ INDIR	Operating cost per available seat mile, dollars.
ST		DIRECT/ INDIR	Cost per block hour, dollars.
ST	TS	DIRECT	Depreciation on flight equipment, dollars.
ST	Ls	INDIR	Passenger trip circ atry factor.

Table A.4 (Continued)

																								-1
DESCRIPTION		Net cash flow, dollars.	Flight crew costs, dollars.	Cost per flight hour, dollars.	Fuel and oil costs, dollars.	Total flying operations cost, dollars.	Capital gains, dollars.	Capital gains tax rate.	Capital gains tax, dollars.	Insurance costs, dollars.	Airframe labor costs, dollars.	Engine labor costs, dollars.	Coach load factor (decimal).	Climb speed, mph.	Climb time, hours.	Total direct maintenance costs, dollars.	Airframe material costs, dollars.	Maintenance burden, dollars.	Engines material cost, dollars.	Cost of fuel, dollars per pound	Cost of oil, dollars per gallon.	Amount of aircraft price financed, dollars.	Cruise speed, mph.	
DEFINING		CFSUB	DIRECT	DIRECT/ INDIR	DIRECT	DIRECT	TAX	TAX	TAX	DIRECT	DIRECT	DIRECT	INDIR	DIRECT	DIRECT/ INDIR	DIRECT	DIRECT	DIRECT	DIRECT	DIRECT	DIRECT	OPLIPE	DIRECT	
COMMON		NI																				N.		
INDEXED 3		¥	rs	ST	ST	ST	Υ,Α		Y,A	ST	ST	ST	ST			ST	ST	ST	st	, d. h		Y, Y		
ARRAY		25	12	12/17	. 12	12	25,100		25,100	12	12	12	17			12	12	12	12			25,100		
VALUE	2005	ပ	ပ	၁	v	၁	ပ	<	ပ	ပ	Ü	1	1	.	ပ	ن 	U	o	0	н		⋖	H	
11	Trie	~	æ	æ	~	œ	æ	æ	~	α.	æ	×	~	~	~	æ	- ad	~	~	~	~	<u>~</u>	~	
VARIABLE	NAME	25	C PC	СЕН	OH O	CF0P	93	CCTAX	XL50	C1	CLA	CLE	CLF	CLS	מנד	75	\$ \$	G G	200	CO FL	C011	COST	CRS	

A-32

Table A.4 (Continued)

DESCRIPTION	Cruise time, hours,	Number of coach seats.	Cumulative total annual revenue, dollars.	Cumulative total net cash flow, dollars.	Cost per cruise mile per seat, dollars.	Cumulative total discounted net cash flow, dollars.	Cumulative total depreciation (double-declin- ing), dollars.	Cumulative total earnings before taxes and interest, dollars.	Cumulative total earnings before taxes, dollars,	Cumulative total initial investment, dollars.	Cumulative income tax sum, dollars.	Cumulative total net earnings, dollars.	Cumulative total operating cost, dollars.	Cumilative total yearly principal payment, dollars,	Average number of stewardesses in coach.	Cost per takeoff per seat, dollars.	Cumulative total yearly interest payment, dollars.	Cost per takeoff, dollars.
DEFINING ROUTINE	DIREC./ INDIR	INDIR	SUM	CFSUB	DIRECT INDIRECT	DCFSUB	MIS	SUM	SUM	SUM	SUM, TAX	SUM, TAX	SUM	SUM	INDIR	DIRECT	SUM	DIRECT INDIR
COMMON BLOCK			#1	IN.		NI	IN	IN	NI _	NI		IN	N.	NI			N.	
INDEXED 3 PARAMETER 3	ST																	
ARRAY DIMENSION	12/17																	
VALUE MODE ²	ວ	H	ပ	ပ	ပ	ပ	ပ	ပ	ပ	ပ	ပ	ပ	ပ	ပ	H	U	ပ	၁
туре	æ	œ	æ	æ	×	æ	æ	æ	«	æ	æ	p¢	œ	æ	es.	ex.	ac	æ
VARIABLE NAME	CRT	cs	CSAREV	CSCF	CSCM	CSDCF	CSDEPR	CSEBIT	. CSEBT	CSINTI	CSINTX	CSNTRN	CSOPCT	CSPRIN	CSTEW	csro	CSYNTR	сто

Table A.4 (Continued)

DESCRIPTION	Distance at maximum payload point on range-payload diagram in miles.	Distance at maximum fuel point on range-payload diagram in miles.	Passenger trip distance, miles.	Discounted cashflow, dollars,	Depreciation (double-declining), dollars.	Total depreciation (straight-line and double-	Descent speed, mph,	Descent time, hours,	Direct operating costs per plane per year,	dollars. Direct operating costs per plane, dollars.	Departures per passenger trip (flight basis).	Earning before taxes, dollars.	Earnings before interest and taxes, dollars.	Economic life, years.	Fraction of RTP that is express cargo.	Fuel at maximum payload point on range-payload diagram in pounds.	Fuel at maximum fuel point on range-payload diagram in pounds.	Coefficient in maintenance labor cost equations	Coefficient in airframe maintenance material cost equations.	
DEFINING ROUTINE	DIRECT	DIRECT	INDIR	DCFSUB	DEPSUB	SUM, TAX	DIRECT	DIRECT INDIR	INPUTS	DIRECT	INDIR	NETSUB	NETSUB	INPUTS	INDIR	DIRECT	DIRECT	DIRECT	DIRECT	
COMMON				NI	N1	Z.						NI	IN	IN						
INDEXED 3	,		ST	¥	Υ,Α	*			Y,A	¥	ST	Υ, Α	Y, A	₩	ST					
ARKAY DIMENSION			17	25	25,100	25			25,100	100	17	25,100	25,100	100	17					
VALUE MODE ²	1	н	-	ပ	ິນ	υ	H	ပ	ပ	S	14	ပ	Ü	<	-	H	н	ပ	U	
T/PE1	Ж	«	æ	œ	æ	æ	œ	~	~	~	~	æ	æ	œ	æ	~	~	æ	«	
VAXIIBLE NAME	D1	B2	DIS	DCF	DEPR	DEPREC	DESS	DEST	DOC	DOC1	TAG	EBT	EBIAT	ECL I FE	EXP	F1	F2	FCAL	FCAH	

Table A.4 (Continued)

DESCRIPTION	Coefficient in engine maintenance labor cost equation.	Coefficient in engine maintenance materials cost equation.	Flight crew cost factor (for a crew of 2) in dollars.	Coefficient in airirame maintenance labor cost equations.	Coefficient in airframe maintenance material	Coefficient in engine labor cost equations.	Coefficient in engine maintenance materials cost equation.	First class load factor (decimal).	Flight time, hours.	Food expense factor for first class.	Number of first class seats.	Average number of stewardesses in first class.	Ground maneuver time, hours.	Cruise altitude, feet.	Inflation rate applied to price of aircraft.	Pointer indicating year number; also miscellan- eous loop index.	Midyear of economic life.	
DEFINING ROUTINE	DIRECT	DIRECT	DIRECT	DIRECT	DIRECT	DIRECT	DIRECT	ANDIR	DIRECT	INDIR	INDIR	INDIR	DIRECT	DIRECTINDIR	INPUTS	OPLIFE	DEPSUB	
COMPON BLOCK																N.		
INDEXED 3								ST	,						*			
ARRAY DIMENSION			•					17							25			
VALUE MODE ²	IJ	ပ	н	ပ	ပ	ပ	Ų	н	O	н	н	н	۱,۸	p-4	<	5	ပ	
TYPE.	æ	æ	æ	æ	æ	a	e	×	œ	æ	æ	×	æ	æ.	a c	H	н	
VAR I ABLE NAME	FCEL	FCEM	FCK	PHÁL	FHAM	FHEL	FHEM	FLF.	RT	FOODR	FS	FSTEW	CAT	×	HINFL	H	IECLIF	

Table A.4 (Continued)

DESCRIPTION	Loop indicator for year value.	Income tax, dollars.	Initial investment, dollars.	Indirect operating costs per plane per year.	unitate. Indirect operating costs per plane, dollars.	Total number of years under consideration (set at 15).	Loop index.	Counter, loop index.	Loop index.	Beginning year of second half of economic life.	Loop indicator for number of aircraft.	Loop indicator for year value.	Aircraft number for particular input data set.	Loop index.	Number of aircraft being considered.	Not used.	Economic life, years.	Economic life, years.	Loop end indicator for number of years.	Number in crew.	
DEFINING ROUTINE	DEPSUB	NETSUB	OPLIFE INPUTS	INPUTS	INDIR	INPUTS	REPAY	DIRECT	DEPSUB	DEPSUB	OPLIFE INPUTS	DEPSUB	DIRECT	REPAY	INPUTS	INPUTS	DEPSUB	REPAY	REPAY	DIRECT	
COMICN		IN	N			N.									Z.						
INDEXED 3		Y,A	Υ,Α	Y,A	∢																
ARRAY DIMENSION		25,100	25,100	25,100	100											122					
VALUE SODE ²	Ç	၁	<	ပ	ပ	4	17	∢	1.1	ပ	1.1	ပ	I,A	77	<		ပ	ပ	၁		
1																					
TYPE		×	æ	-		H	- -	-	-	1	·	н	-	Н	н	<u> </u>	Η	1	_	_	

Table A.4 (Continued)

VARIABLE NAME	туре	VALUE MODE ²	ARRAY DIMENSION	INDEXED 3	СОМРОИ ВІДСК	DEFINING ROUTINE	DESCRIPTION
NRENGN	1		!			DIRECT	Number of engines.
NRSEAT	H	H				DIRECT	Number of seats.
NSL	H	H				DIRECTINDIR	Number of stage lengths (up to 12 for DIRECT, up to 17 for INDIR).
NTEARN	~	ပ	25,100	۷,۲	IN	NETSUB	Net earnings, dollars.
NUSTAG	ν'1					DIRECT	Flag to reread name list NSTAGE.
OPCOST	æ	U	25,100	Υ,Α	IN	INPUTS	Operating cost, dollars.
PBCOST	~	ပ				REPAY	Amount of aircraft price financed, dollars.
PRICE	~	A ,C	25,100	Υ,Α	NI	OPLIFE INPUTS	Price of new aircraft, dollars.
PRIN	øs.	ပ	25,100	Α,Υ	IN	REPAY	Yearly principal payment, dollars.
PV	œ	ပ	25	*	IN	DCFSUB	Present value discount factor
æ	æ	۷			IN	DCFSUB	Interest rate for PV calculation (ROI).
RATE	ద	ပ				DEPSUB	Rate of depreciation.
ксн	os.	H				DIRECT INDIR	Rate of climb at cruise altitude, feet per win- ute.
RCSL	æ	H				DIRECT	Rate of climb (sea level), feet per minute.
RES	~	∢	100	V	IN	INPUTS	Residual fraction of aircraft price for salvage.
RI.	~	н				DIRECT	Maintenance labor rate, dollars per hour.
RRATE	e 4	<	100	∢	N	INPUTS	Interest rate for repayment of purchase loan.
RTE	~	υ				INDIR	Express tons enplaned.
RTF	æ	ပ			بعسي	INDIR	Freight tons enplaned.
RTM	~	н			_	INDIR	Tons of mail carried per flight.

Table A. + (Continued)

VARTABLE NAME	TYPE ¹	VALUE MODE ²	ARRAY DIMENSION	INDEXED 3	COMMON	DEFINING ROUTINE	DESCRIPTION
RTP	×	1				INDIR	Tons of property (cargo) carried per flight.
SALVAG	æ	ပ	25,100	Y, A	NI	DEPSUB TAX	Value of aircraft at end of economic life, dollars,
SAREV	æ	၁	25	> -	NI NI	SUM	Yearly total annual revenue, dollars,
SB	æ	ပ	17	ST		INDIR	Block speed, uph.
scc	ei.	ပ	25	>		TAX	Total yearly capital gains, dollars.
SCCTX	æ	၁	25	¥		TAX	Total yearly capital gains tex, dollars.
SDEPR	æ	ن ت	25	¥	NI	NUS	Yearly total depreciation (double-declining),
SEBIAT	ps.	ပ	25	,	NI N	SUM	dollars. Yearly total earnings before interest and taxes, dollars.
SEBT	~	ပ	25	*	NI	RUN	Yearly total earnings before taxes, dollars
SEXP	æ	ပ —	25	¥		TAX	Total yearly expenses (excluding taxes),
SINCOM	×	ပ	25	¥		TAX	Total yearly earnings before taxes, dollars.
S INCTX	œ	ນ	2.5	٨	ZI	Sum	Yearly income tax sum, dollars.
TS	« ———	н	12/17	ST		DIRECT/ INDIR	Plight stage length in miles.
SNTERN	~ 	ن -	25	×	IN	SUM	Yearly sum of net earnings, dollars.
SOPCST	~	Ü	25	¥	N.	SUM	Yearly sum of operating costs, dollars.
SPRIN	ρ <u>κ</u>	ပ	25	X	N IN	SUM	Yearly sum of principal payments, dollars.
SSALVG	~	Ü	25	¥	IN	SUM, TAX	Yearly sum of salvage value, dollars.
SSTDP	æ	ပ —	25	>	Z.	Sur	Yearly sum of straight-line depreciation,
STDEP	œ	ပ	100	<	NI.	DEPSUB	Straight line depreciation, dollars.
STLIFE	α .	ပ				DEPSUB	Economic life for straight line depreciation,
SYNTRS	ac.	ບ	25	>	N.	Mus	Yearly sun of interest payments, dollars.
SUM	æ	ن -				DCFSUB	Total accumulated present value of cash flow, dollars.
			7				

Table A.4 (Continued)

NAME 1	TYPE	VALUE MODE ²	ARRAY DIMENSION	INDEXED 3	COMMON	DEFINING ROUTINE	DESCRIPTION
	1						
T	~	Н				DIRECT	Time factor in engine labor cost equations.
TAP	ac	ပ	17	ST		INDIR	Advertising and publicity expense ('otal),
TAS	~	၁	17	ST		INDIR	Total aircraft servicing expense, dollars.
TB	~	ပ	17	ST		INDIR	Block time, hours.
TRS	~	IJ	17	ST		INDIR	Total reservation and sales expense, dollars.
TTS	œ	ပ	17	ST		INDIR	Total traffic servicing expense, dollars.
TXRATE	~	۷				INPUTS	Tax rate for income tax.
	~	H				DIRECT	Annual utilization per aircraft in block hours.
٧٨	æ	1				DIRECT	Airframe cost, dollars.
VE	×	ı				DIRECT	Unit engine cost, dollars.
5	~	U				DIRECT	Aircraft total cost, dollars.
NA W	~	ပ				DIRECT	Airframe veight, pounds.
MEM	~	ပ				DIRECT	Aircraft empty weight, pounds.
KEN	æ	ပ				DIRECT	Unit engine weight, pounds.
WGR	×	-				DIRECT	Gross vehicle weight, pounds.
XNAME	4	м	20	Id		DIRECT	Comment card label for output table head: ugs.
YNTRST	æ	υ	25,100	Y,A		REPAT	Yearly interest payments, dollars.
YRPPAY	~	ပ	25,100	Y, A		REPAY	Year . y principal payment, dollars.
•							
-							

Table A.4 (Concluded)

0,

lype of variable classification:	² Value mode classifications:	Indexed parameter
A = Alphanuzeric I = Integer R = Real	<pre>C = Value calculated in program I = Read from input file A = Value assigned in program I,I = Loop index</pre>	ST = Stage Leng A = Aircraft Y = Number of DI = Data item

Appendix B
DESCRIPTION OF PLOTTER SOFTWARE ROUTINES

Appendix B

DESCRIPTION OF PLOTTER SOFTWARE ROUTINES

The plotted output of the Fleet Accounting Module is generated on the ZETA PLOTTER 230, using a CDC 7600 computer. The plotter software used by the Fleet Accounting Module is described in this appendix. This software includes subroutines PLOT, SYMBOL, PLOTS, RSTR, LINAXS, and NUMBER. The descriptions provided here were extracted from internal NASA Ames documentation. Listings of the source code for the routines are provided in Appendix C.

SUBROUTINE PLOT(X,Y,IPEN)

PLOT performs the basic plotting function of moving the pen from its current location to a specified location with the pen either up or down.

X,Y - The coordinates (in inches) of the point to which the pen is to be moved. The positive X direction is defined as parallel to the margin of the plotting paper and toward the clean roll (package) of paper (i.e., from left to right in the normal fashion as one stands alongside the plotter in the indicated position).

L. C. Evans, "Memorandum for Systems Studies Divison Staff on Plotter Software," NASA-Ames MS:202-8, Moffett Field, California (April 1974).

- IPEN The magnitude of IPEN specit is the operation to be performed:
 - IPEN = 0 No change in pen position; present pen location
 is redefined as (X,Y).
 - Pen is moved to (X,Y) without raising or lowering the pen.
 - = 2 Pen is moved to (X,Y) with pen down.
 - = 3 Pen is moved to (X,Y) with pen up.
 - 4 No pen movement; the current location of the pen is returned in (X,Y).
 - = 5 Initialization call; used by PLOTS.
 - Pen is moved to a new "page", the plotter buffer is dumped, and the pertinent parameters are reinitialized, readying the plot software either for termination of the program or for a new plot.
 - * 7 Used to change the plotting factor (if $X \ge 0$) or the plotter grain (if $X \le 0$ and $Y \ge 0$); no operation if $X \le 0$ and $Y \le 0$. This value of IPEN should not be used unless the user is familiar enough with the coding of PLOT to understand what effects changes in these values will have.
 - = 8 Pen is raised but not moved.
 - = 9 Pen is lowered but not moved.
 - = 10 (not currently used).
 - = 11,12,13,14 Same as IPEN = 1,2,3,4, except that plot is offset, scaled, and rotated.
 - = 20 Same as OPEN = 13, except that pen position is saved.
 - = 21,22,23 Same as IPEN = 11,12,13, except that pen movement is calculated relative to the pen position saved from the last call to PLOT with IPEN = 20.

In the case of 1PEN = -1,-2,-3,-11,-12,-13,-21,-22,-23, the action is the same as that described above, but after the new pen location has been reached, it is redefined as the origin.

SUBROUTINE SYMBOL (XLLHC, YLLHC, HEIGHT, BCD, ORIENT, NCHAR)

BCD

SYMBOL causes a string of alphanumeric information to be plotted.

XLLHC, YLLHC - For the purposes of visualization, each character can be thought of as being drawn inside a rectangle whose size is determined by the value of HEIGHT. The size of the rectangle is the same for all characters involved in a given call to SYMBOL. The value of (XLLHC, YLLHC) gives the coordinates of the lower left-hand corner of the rectangle associated with the first character to be plotted.

HEIGHT - The height of the characters (in inches). The width of each character, for the purposes of determining the length of a plotted character string, is 0.8*HEIGHT.

- An array containing the character string to be plotted.

ORIENT - The orientation at which the string is to be plotted, measured CCW in degrees from the +X axis.

NCHAR - The number of characters to be plotted.

If NCHAR is less than zero, one of a series of plotting symbols is drawn centered on the point given by (XLLHC,YLLHC). Fifteen symbols are available, and the one drawn is determined by the absolute value of NCHAR (taken modulo 15) according to:

-NCHAR	Plotting Symbol
1	square
2	circle
3	triangle
4	cross ("plus" sign)
5	cross ("X")
6	diamond
7	tilted hourglass
8	upside-down teepee
9	Z
10	Y
11	lozenge
12	asterisk (comb. of 4 & 5)
13	hourglass
14	vertical line
15	star

The standard character set, as represented by the symbols on the 029 keyboard, is available through SYMBOL, with the exception of the following nine symbols: $,|,',@,\neg,\&,c,\#,0-8-2.$

SUBROUTINE PLOTS(LUN)

PLOTS performs all of the necessary initialization for the plotting software. It should be called prior to calling any other routine in the package.

LUN - Logical unit number. In addition to transmitting this information to the plotting routines, a tape of this number must be declared in the user's PROGRAM statement.

SUBROUTINE RSTR(IARG)

RSTR generates the call CALL PLOT(0.,0.,6) in order to clear the plotting buffers and move to a new page.

IARG - A dummy argument; it is ignored.

SUBROUTINE LINAXS(XO,YO,X1,Y1,LABSIZ,WHICH,NTIC,NLFREQ,VALO,VALMAX, NDIGIT,NLABEL,LABEL)

LINAXS plots and labels a linear axis.

XO - X coordinate of the left-hand edge of the plot in inches.

YO - Y coordinate of the lower edge of the plot in inches.

X1 - X coordinate of the right-hand edge of the plot in inches.

Y1 - Y coordinate of the upper edge of the plot in inches.

LABSIZ - (REAL) Size of the labels in inches.

WHICH - (INTEGER) Indicates whether a horizontal or vertical axis is to be plotted:

> WHICH = +1 vertical = -1 horizontal

NTIC - Number of tick marks, including one at the end of the axis.

This is also, therefore the number of intervals into which
the tick marks divide the axis.

NLFREQ - Frequency with which tick marks are to be labeled.

VALO - Value of the axis variable at the beginning of the axis.

VALMAX - Value of the axis variable at the end of the axis.

NDIGIT - Number of significant digits to be used in writing tick mark labels.

NLABEL - Number of characters in axis label.

LABEL - Array containing the axis label.

SUBROUTINE NUMBER(XLLHC, YLLHC, HEIGHT, A, ORIENT, N)

NUMBER converts a number to its EBCDIC representation and plots it.

XLLHC, YLLHC - The coordinates in inches of the lower left-hand corner of the character string to be plotted. (See the write-up for SYMBOL for a more complete explanation.)

HEIGHT - The height in inches of the number on the plot.

A - The number which is to be converted and plotted; is considered to be an array if N is a FORMAT.

ORIENT - The orientation at which he number is to be plotted.

N - If the absolute value of N is less than 20, then the value of N is the number of decimal places to be included. If the absolute value of N is not less than 20, then N is assumed to be an array containing the FORMAT with which the number(s) in A are to be plotted. If N contains a format, then the element of the array following the end of the format must contain all EBCDIC blanks, and the next word must contain the number of values in the array A which are to be written. The character string generated by the format must be no more than 1000 characters long and must be terminated by an "@" symbol.

If HEIGHT is less than zero, (XLLHC, YLLHC) is assumed to specify the lower right-hand corner of the last character to be plotted.

Appendix C

LISTING OF PROGRAM SOURCE CODE FOR THE FLEET ACCOUNTING MODULE

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Appendix D

LISTING OF PROGRAM SOURCE CODE FOR THE AIRFRAME MANUFACTURER MODULE

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145 WAITE (6.23.) 20EV. EIRROC. ERRICE. ESEPOT(1) 1. T75, F20.4/ 1. T76, ESTIMATED AIRPLANE DAIRLE SET CNST. MILLIONS T75, ACPRICE ACPRICE AT T75, F21.4/ 1. T75, F11.4/ 1. T75, F21.4/ 1. T16. ESTIMATED AIRPLANE PRICE AY SEAT CNST. MILLIONS, (ESEPR(1))., ACPRICE			ACPRICE ACPRICE	143
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214			CUSTER	158
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	175, of D 1 4 Ee, 146, estimates.	COSTBE	212
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215	STe//)	CUSTP	216
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Appendix E

LISTING OF PROGRAM SOURCE CODE FOR THE AIR CARRIER MODULE

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4/26/79 09:41.54		
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	TABEL	5
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MATERIAL - ENGINE	IRECT	101
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		OIRECT	124
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135	TENER (6.94) (PLACE) PARTE	DIRECT	136
	(6,95) (CRT(I), I-1, MSL)	DIRECT	137
	(46.41)	JIRECT	136
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SUBROUTINE DIRECT		16/76 04	001-1	Ī.	FIN 4.6+603.	94/26/79	69.41.54
	106 FORMATTO	AATERIA		0,10F0.33		DIRECT	173
	100 FORMATION FATERIAL ENGINES 100 FORMATION FAINT BURDEN 110 FORMATION OF MAINTENANCE 112 FORMATION OF TOTAL MAINTENANCE	MATERIA MAINT TOTAL TOTAL	PERATING	- 10fe.31 - 10fe.31 - 10fe.31 - 10fe.31			
0	13 FORMATC * SFEIGHT HOUR 114 FORMATC * SPEIGE HOUR 115 FORMATC * SANAIL. SEAT C COST PER CRUISE RILE FOR	*/* TICK */FLIGH */BLOCK */AVX! */AVX! */AVX!	113 FORMATO S/FLIGHT HOUR 113 FORMATO S/FLIGHT HOUR 114 FORMATO S/FLIGHT HOUR 115 FORMATO S/AVAIL. SEAT MILE COST PER CANDER COST PER CANDER THE ARCRAFT CATHER FORMATO SEAT MILE AND	0,10f6.1; 0,10f0.1; 0,10f0.3;			
	C COST PER TAKEOFF FOR THE COST PER CANUS NILE PER CSCN-CACH/NRSEAT CSCN-C	AAAOFF F 110-CACA 12156 31 1788641	COST PER TAKEOFF FOR THE AIRCRAFT CTO-(CANIL)-CACN)-SL(1) COST PER CRUISE NILE PER SEAT CSCHOCACHARSEAT COST PER TAKEOFF PER SEAT				
190	CSTO-CTO/MRSEAT WRITE (6.116) CI WRITE (6.117) CI 116 FORMAT (606.0 CC	/MRSEAT 1116) CT 117) CS	CSTO-CTD/MRSEAT NRITE (6,116) CTD,CACM Urite (6,117) CSTD,CSC4 Format (600,0 COST PER AIRCRAFT TRIP 0 80,F7.2,0 PLUS \$0,F6.2, 0/NILE0)	• \$0.F7.23	PLUS 84,F6.2,	DIRECT DIRECT DIRECT DIRECT	
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		FLIGHT CREW COSTS FLIGHT CREW COSTS 00 500 11.0 WS. C(I) - (WGR05.0E-5+FCK) FUEL AND OIL COSTS D(I) - (L.02.0. CGFL08FC)	FLIGHT CREW COSTS FLIGHT CREW COSTS 00 500 1=1, MSL CFC(I)=(WGR*9.0E-5+FCK) FUEL AND OIL COSTS CFO(I)=(1,0E*,0E*,0E*,0E*,0E*,0E*,0E*,0E*,0E*,0E*	15* COIL*61	(1))}2F(1))\$84[]		7
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FTN 4.6+463	AMES STUDY (1976)	ARAMETERS, THEN CALCULATE BASIC En aircraft	1417), CF(17), OPT(17), SL(17), C6(17), 17), CLL(17), CLZ(17), CL3(17), CL5(17), 18(17), CL9(17), CZ0(17), CZ1(17),	4C27(17) F4P(17) C26(17) C26(17) C20(17) C31(17) C32(17) F5C3(17) C32(17) F5C3(17) F	TEM 1004 110 112 A+ BAG+RTH+RTP			BR EACH AIRCRAFT - READ AND WRITE				
IR 76/76 0PT-1	SUBROUTINE INDIR(18C1,4MC) DINEMSION ISCATISD) THIS IS THE ISC PROGRAM FOR A	IMPUT BASIC INDIRECT COST PARAMETERS. IMDIRECT UPERATING COSTS PER AIRCRAFT	DIMENSION DESCIPPITBUILTES 1 CF(17)-CO(17)-CO(17)-CLO41 2 CLS(17)-CLS(17)-CL(17)-C 3C22(17)-C23(17)-TES	4C27(17)	MAMELIST/STEMS/ALS-FSTEW-CST MAMELIST/FGDD/ALG-FS, CS-FGDD/ MAMELIST/AKFLIAIT MAMELIST/ACSERV/ALD-ALG-ALL MAMELIST/TRAFF/ALLL-ALLS-ALL	MAMELIST/RES/ALIS·ALIS·EKP Mamelist/Adv/ Alis·Alit Mamelist/Maint/Alid·Alis·Alid·Alit Mamelist/Genadm/Alil·Ali·Ali·Ali·Ali	M-WAC MPLAME-1	MAIM PROGRAM CYCLE POINT FOR EACH AIRCRAFT INFUT LISTS NUSTAG=0 WRITE(b.512) FORMAT(*!*)	REAGOSTOLO MAME FORMAT (2044) WRITE (4.5 1.1) MAME FORMAT (5 x, 2044) REAGOSTOLO MES	READISONSTAGE) WRITE(6.NSTAGE) READISONSTAGE) READISONSTAGE) READISONSTAGE)	MRITE(&FOOD) READ(S»PAKFLT) WRITE(&PAKFLT) READ(S»ACSERV) WRITE(&»ACSERV)	READUS, TRAFF) URITE(S,TRAFF) KEADUS,RES)
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120	ა ა	TAS(10=C15(1)+C16(1)+C17(1) TAAFFIC SERVICING EXPENSE PASSENGER FIRST CLASS C10(1)=A1110FS0FLF(1) TAAFFIC SERVICING EXPENSE PASSENGER COACH	AND	0122 221 221 231
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			AITE (6,9	2) (5	14(1)	-1,450)				ON I	.	261	
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9			MITE (6.1)		==	3 - 1 - 1 - NS	3,			ON S	=:	102	
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			HITE (6,1)	11) (5	17(1)	p.I = 1, 25.				11011	=	207	
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9		-	MITE (6,1	13) (C	23(1)	o I - Lo MSL				2	.	210	
913		- 4	RITE (6,2)		15(1)	15H 41-14	•				œ º	112	
			MITE (6.1)	151	27 (1	1. I-1. HS	. =			9	. <u></u>	211	
			RITE (6,2)) 	25	3-1-1-C	25			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	. ,	21.0	
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250	114 FDREATE OF OFFICERATION A SALFS OF			251
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295		40 0-1354		
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	217 FORMATCO TOTAL ADMENTISTME A PUBLICATIV	AP 4-136A	TROTE	
	110 FORMATIC MAINTENANCE EXP. GRD PROP A EQUIP	C32 0x13F0x31		250
	119 FORMATIO DEPR-SEMERAL SED PROP - GOULP - AMOR	33 0.10Fe	INDIA	260
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	121 FORMATIO GENERAL A AON EXPENSE	35 +, 1850	MONI	262
	122 FORMATIO TOTAL INDIAECT OPERATING EXPENSE	36 -, 10 5	LADIA	263
	123 FORMATI + INDIRECT COST PER AIRCRAFT MILE	1350	WION!	192
	124 FORMATC+ INDIRECT COST PER FLIGHT HOUR	*, 10F	LADIA	592
\$65	125 FORMATIO INDIRECT COST PER BLOCK MOUR		RIGHT	266
	126 FORMATIO INDIRECT C.ST PER AV. SEAT MILES	*, 10F	AIGNI	267
	C COST PER CRUISE MILE FOR THE AIRCRAFT		AIQX:	992
	CALRELLARICATIONS ASSESSED CONTRACTOR ASSESSED		¥70K1	402
270				27
•	C COST PER CRUISE MILE PER SEAT		INDIE	272
			INDIA	273
	C COST PER TAKEOFF PER SEAT		INDIR	274
	CSTO-CT:/NRSEAT		NON Y	275
572	WRITE 16,316, CTO,CACH		INDIR	276
	WALTE 16-317) CSTO-CSC		LADER	277
,	FURNA? (*0*,*	200 FLUS \$05 F6. Z5	MIGHT	272
	FORMAT (404.4 COST DEP CRAT TRID a	\$4.65.7.4 Bill 48.65.4.4.40m1 541	TION I THE	222
200	+1			
	IF (MPLANE, 6T.N) GO TO 20		INDIR	282
			LIGHT	283
	C CYCLE UNTIL ALL AIRCRAFT MAYE BEEN PROCESSED		INDIR	787
			HONN	502
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SUBROUTINE INDIR 76/76 OPT-1.
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SUBROUTINE REPAY	REPAY	76/76 08	001-1		MT.	4.6+60	ě	61.19214	09.41.54
7	•	UBROUTINE REPAY						REPAY	~ ~
		CALCULATE REPAYMENT	ENT SCIEDULE	FOR EACH	AIRCRAFT			REPAY	• • •
•		ISTON AREVEZ	5, 100), CF425	1, COST(25.	1001			REPAY	• •
	10CF (2	31.DEPR(25.	locking by both miles and both moderation with the moderation of the moderation of the moderation of the miles of the miles of the moderation of the miles of the	5 - 100) - EBT	(25,1001,E	CLIFE(103.)		REPAY	~ •
	3PRIN(25,1001, PV(251, RES (133)	, KRATE (100	J. SALVAGIZ	5,100),	•	REPAT	• •
	4 S T D E P	(25. 100) . TH	TAST(25, 100)					REPAY	10
01	ASTARC STATE	(25), SSALVG	125) - SINTING	251 SPRING	251, SJPCST	(25), SOEPR	(25)	REPAY	
	705 705		11231,5TRTKS 125,1001,CTD	(25)	X 1 2 K 1 S 0 (6 2	(25) p SMTER	M 25) ,	REPAY	7.
	BSEXP	251, SINCON!	2510 CG(25010	DI BVALUE	25,1001,55	6(23).		REPAY	3 2
	9C 6 T K (25,1001,556	TX(25), TRPPA	Y(25,100)				REPAY	\$1
<u>.</u>	LEVEL	. Zo AREV.	3		, 400	. 20020	. 60 50 5	REPAY	4:
	105681	To CSEBT	CSINTI	SINTE	CSSTRE	CSOPCT	CSPEIN	REPAY	1
	2CS YNTR.			DEPREC.	EDIATA	607,	ECLIFE	REPAT	0
į	31,			LYEAR	MAC	MTEARN	OPCOST	REPAY	2
20	WING T			SALVAGA	SAREVO	SOEPR	SEBIATA	REPAT	7
	6551060	P. STOFF.	- 21417	VATORA	20402	27414	SSAL VG.	REPAY	25
	70057	_	RES	RRATE	TXEATE			REPAY	2 2
	BVALUE)					REPAT	52
52	LEVEL	2						REPAY	\$2
	COMMON	ž	CF	CSAREVO	CSCF,	CSOCF	CSDEPR	REPAT	27
	1C2EBILD	To CSEBT	CSIMILL	CALATA	CSNTRR	CSOPCT	CSPAIN	REPAY	72
	21.			VEFEL	• 1 4 1 6 P 1 9 P		11111	REPAT	62
30	4 PRIN.		_	SALVAGO	SAREVA	SDEPR	SERIAT	REPAY	9 6
	5 S E D T ,		•	SATERM	500:57	SPRIM	SSALVG	REPAY	35
	655T0EP.	P. STOEP.		THTASTA		!		REPAT	33
	75051	4	_	RRATE	TKRATE			REPAY	Ť
		2						REPAY	S
2	REAL	CONTRACTOR CONTRACTOR OF ALL FORESTERS	AKIMTEARM					REPAY	4 P
J								REFAT	
		LOOP POINT	MAIN LOOP POINT FOR EACH AIRCRAFF - SKIP	CRAFF - SK.		PROCESSING WITHIN LOOP	100	REPAY	•
		T FOR FIRST	YEAR CRAFT	IS PURCHAS	9			REPAY	9
	G	Jehrman						REPAY	.
	16 (0	OST(I.A)	ate.b.o. en ro	60				ACFAI	25
	PBC05	BC051-C05T(1, J)						REPAY	, ,
								REPAY	
45		CALCULATE TOTAL	ANNUAL PAYMENTS	MTS IPRINC	IPRINCIPAL PLUS INTEREST	INTEREST		REPAY	9
•								REPAY	47
	1 ((1)	RATE(1) > 00		} • (E (1)) * * ECL	1 FE (1)) /		REPAY	- C
	MLIFE	· ECL [FE(1)						17430	.
90	+T-NN	=						REPAY	276
	00							REPAY	25
, 0	CALCULATE	LATE INTERE	INTEREST AND PRINCIPAL PAYMENT SCHEDUL	IPAL PAYRE	IT SCHEDUL	•		REPAY	m 4
u						•		REPAY	
2	YNTRS	T(No.1) . PB	THIRSTER-19 - PECOSTORANTECL)					REPAY	3.5
	SOUNA	PRINCES - TRPPAY (1943)	AY(Lof) - YN [M(m.l)	TRST(N.J.				REPAY	25
)							•	2

PAGE 04/26/79 09.41.54 FTM 4.6+463 END OF MAIN PROGRAM LOOP 90 CONTINUE RETURN END 76/76 OPT-1 SO CONTINUE SUBROUTINE REPAY

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SUBROUTINE DEPSUB	0£ 9 S	^	6/76 091-1			FTR	4.6.460	8	04/26/79	09.41.54
-		SUBROUTINE	E DEPSUB						DEFSUB	~-
	ں ں	CALCULATE	DEPRECIAT	TOM SCHEOU	LE FOR EAC	H AIRCRAFT	- 000061.6		SEPSUB	~
	U	ECLININ	BALANCE	ETHOO FOR	G BALANCE METHOD FOR FIRST HALF OF ECONOMI	OF ECOND!	C LIFE A	¥0	0 E P S U B	•
•	، ن	TRAIGHT	LINE RETHO	O FOR BALA	MILE OF ECO	MONIC LIFE				۰ ۵
		DIMENSION	AREVEZS.1	00).CF(25)	,:05T(25,1	• 100			0673G	• •
		10CF(25),0	EPR (25, 100	1) - EBIAT(25	, 1001, EST	25, 1001, EC	LIFE(100)		0EPSUB	•
		ZINCTAX (25	. 100) . INT	NV (25, 100)	PATEARNIZ	, 1001 - OPC	181(25,130	•	DEPSUB	9 :
27		3PRIM(25, 1	.00), PU(25)	, 4ES (100),	RRATE(100)	, SALVAGI 25	1001		067508	12
		5 SARE V(25)	\$5ALV612	D SINTINGS	9) , SPR 1M (2	51.50PCST	(25) , SDEPR(25)	251	DE P SUB	12:
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2		310	INCTAX	INTENV	LTEAR	MAC	NTEARN	070051	06750	22
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96		2CSYNTR, 31.	THUTAY	DEPR	OFFREC.	EBIATA MAC.	EBT, MTFARM,	DECLIFE,	067508	0 = M
•		4981H			SALVAGO	SAREV	SDEPR	SERIATA	DEPSUR	32
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IVE SUNS FOR	DIMENSION AREVESS-1001.CF(251.COST(25.1001.	/ INT. A.K. (2) - LUU) / A.K. (2) - LUU) / A.K. (2) - LUU) / LUC (2) - LUU) / C.K. (2) - LUU) / A.K.	25), SPRINI (25), SEBT	7DEPREC(25).PRICE(25.100).CSOCF(25). 0SEXP(25).SIMCOM(25).CG(25.100).BVALUE(25.100).SCG(25). 9CGTK(25.100).SCGTK(25).	CSAREV	DEPRECE	IVEAR	SALVAGA	THIRST		SAREV	DEPRECA	IVEAR	SALVAGA	YMTAST	RRATE,		TOOPS TO CALCULATE THE BEOUTEED SHAN		1. [VEAD)											
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021	11	FORTAT (* DEPRECE **10F12.4)		E S	121
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SUBROUTINE TAX	1 AX	76/76 OF:*1	FTN 4.6+463	04/56/79	09-41-54
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120	•	SINCTRIN = 0.0 CONTINUE CONTINUE CONTINUE CONTINUE STERMIN = SEBTIN > 0 STERMIN = SEBTIN > 5 STERMIN = SEBTIN > 5 STERMIN = SEBTIN > 5		######################################	6 0 1 2 5 5 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
125	2 2	SINCTXIN) = SINCTXIN) + SEBTIN) • TXRATE CONTINUE DO 90 L=2, IYEAR PH-L-I DEFECIL) = DEPRECIL) + DEPRECIN) CONTINUE		**************************************	
130		CALCULATE CAPITAL GAINS TREATMENT LONG TERM CAPITAL GAINS TAX DO 11 J-12-NAC		44444 44444 14444	
135	2 %	MECLIFE(J)-1 500 75 L-1,M ASSUME SALVAGE VALUE ZERO SALVAG(L-1)-0.0 MACCLIFE(J)		*******	0 ~ 0 ~ 0 ~ 0 ~ 0 ~ 0 ~ 0 ~ 0 ~ 0 ~ 0 ~ 0 ~
\$ \$	11,5	SALVAG(L) -PRICE(1, J) +RES(J) DO 11 M-1, IYEAR SSALVG(M)-0.0 SSALVG(M)-SALVAG(M, J) +SSALVG(4) CONTINUE CAPTAL GAINS-CG CAPTAL CAINS-CG DO 111 J-1, MAC		**************************************	200 955 9
150 155	3 :	CG(L, J) = 0.0 CG(X(L, J) = 0.0 CG(X(L, J) = 0.0 CF(CG(L, J) - 0.0 IF(CG(L, J) - 0.0 IF(CG(L, J) - 0.0 IF(CG(L, J) - 0.0 CGTAR = 0.30 GG TO 3		**************************************	
160	333	CGTAX+0.0 CGTAX+0.0 CGTX(L, J) *CGTAX*CG(L, J) CG(L, J) *CG(L, J) *CGTX(L, J)			00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
165 176	,,,,	UPDATE CUMULATIVE SUNS 00 06 N=1, IYEAR \$C6(N)=0.0 \$C6TKN)=0.0 50 06 J=1,NAC WRITE(6.0) C6(N, J) FORNATI* C6 * * E12.4)		**************************************	5 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

SUBTOUTINE TAX	E TAX	76/76 OFTel	FTM 4.6+460	04/26/79	09.41.54	PAGE
		SCG(Z) * CG(Z * 7) * SCG(Z) SCG(Z) * CG(Z * 1) * SCG(Z)		TAX	173	
175	22	CONTINUE DO 95 X-1-1-1 YEAR SYTERN(2)-SYTERE (2)-SYTERN(2)		1444 1444 1444	175	
	•	SINCTX(N) -SINCTX(N) + SCGTX(N) CONTINUE		TAX	176	
100	201	CSEGT=0.0 00 102 N=1,1YEAR 0569T=SEGT(N)+CSEGT CONTINGE		1444 1444	0125	
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Appendix F

COSMIC SOFTWARE SUBMITTAL INFORMATION

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COSMIC SOFTWARE SUBMITTAL INFORMATION

Abstract

The Analysis of the Benefits and Costs of Aeronautical Research and
Technology (ABC-ART) models have been developed by NASA for use in analyzing the economic feasibility of applying advanced aeronautical technology
to future civil aircraft. The methodology is composed of three major modules:
Fleet Accounting Module, Airframe Manufacturer Module, and Air Carrier Module.

The Fleet Accounting Module is used to estimate the number of new aircraft required as a function of time to meet demand. This estimation is based primarily upon the expected retirement age of existing aircraft and the expected change in revenue passenger miles demanded. Fuel consumption estimates are also generated by this module. The Airframe Manufacturer Module is used to analyze the feasibility of manufacturing the new aircraft demanded. The module includes logic for production scheduling and estimating manufacturing costs. For a series of aircraft selling prices, a cash flow analysis is performed and a rate of return on investment is calculated. The Air Carrier Module provides a tool for analyzing the financial feasibility of an airline purchasing and operating the new aircraft. This module includes a methodology for computing the air carrier direct and indirect operating costs, performing a cash flow analysis, and estimating the internal rate of return on investment for a set of aircraft purchase prices.

The ABC-ART models are exercised in two distinct job steps. The Fleet Accounting Module and Airframe Manufacturer Module are run in one job step. The Air Carrier Module is run in a second job step. The modules are

designed for batch processing. Hardware requirements include a card reader, a printer, and disk storage. In addition, plotter output is generated by the Fleet Accounting Module. The software is currently programmed for a ZETA 230 plotter. The models have been run of a CDC 7600 with the SCOPE 2.1.3 operating system. CPU time is very modest for either job step. However, core requirements are substantial. The first job step requires 132K octal words, the second requires 154K octal words small core memory plus 144K octal words of large core memory.

Method of Solution

The methodology embedded in the ABC-ART models is described in detail in Volume I of this report (NASA CR-152278). The methodology for the Fleet Accounting, Airframe Manufacturer, and Air Carrier Modules are described in Sections II, III, and IV, respectively.

Computer Configuration Required

The ABC-ART models have been run on the NASA AMES CDC 7600, with the SCOPE 2.1.3 operating system. The only required input device is a card reader. Required output devices include a printer, a plotter, and disk storage. The job step which exercises the Fleet Accounting and Airframe Manufacturer Modules requires a printer, a plotter (software is provided for the ZETA 230 plotter), and four output disk files, two for storage of data generated for the plotter and two for temporary storage of input data. The job step that exercises the Air Carrier Module requires only a printer and a card reader.

Memory Required

On the CDC 7600 there are two types of memory, small core memory (SCM) and large core memory (LCM). The Fleet Accounting and Airframe Manufacturer Modules require 132K octal words of SCM and no LCM. The Air Carrier Module requires 154K octal words of SCM and 144K words of LCM to run. Variables were placed in LCM using the LEVEL 2 conversion for the CDC 7600.

Source Language

The ABC-ART models are programmed in CDC FORTRAN extended 4 language. The reference manual for this language is CDC Publication Number 84000009. The ZETA 230 plotter software is written in the same language, except for a single COMPASS routine (less than 1% of the code). COMPASS can be compiled using the CDC FORTRAN compiler.

User Instructions

Instructions for use of ABC-ART models are provided in Volume I, Section V of this report where a sample run of the models is described.

Implementation Instructions

The software package is being submitted in the five data sets. Each data set consists of a single tape file except for the fifth data set, which is composed of four tape files. These files are described below:

On the NASA Ames computer system, 160K octal words of SCM and 1,200K octal works of LCM are available.

Data Sets	Tape File	Contents
1	1	FORTRAN source code for the Fleet Accounting and Airframe Manufacturer Modules (see Appendices C and D).
2	2	FORTRAN and COMPASS source code for the ZETA 230 plotter software.
3	3	FORTRAN source code for the Air Carrier Module (see Appendix E).
4	4	Data input for the sample run of the Air Carrier Module (see Volume I, Table 41).
5	5,6,7,8	Data input for sample run of the Fleet Accounting and Airframe Manufacturer Modules (see Volume I, Table 40).

The tape containing these files is an unlabeled, 9-track tape in the EBCDIC character set with a density of 1600 BPI. The logical records are in card image format, 80 characters in length with no blocking. The tape was written on a CDC 7600 computer in SCOPE stranger format (i.e., F=S). No job control language is included in any of the files.

Program Timing

The CPU time required to run the ABC-ART models is quite modest. It will vary with the problem analyzed, the main factor being the number of new aircraft types. The sample run of the ABC-ART models, described in Volume I, Section V, took 22 and 4 CPU seconds for the Fleet Accounting and Airframe Manufacturer modules and Air Carrier Module, respectively. This time includes 5 and 3 CPU seconds, respectively, for compilation.

Accuracy of Results

The ABC-ART system does not contain mathematical or statistical routines that are very sensitive to word size. Single precision calculations on the CDC 7600 use a 60-bit word which provides a high degree of accuracy in computed results.

Sample Input and Output

Volume I of this report provides sample input and resulting output.

In Section V, the sample problem is described, including a listing of the card input. Excerpts from the resulting printed and plotted output for the Fleet Accounting, Airframe Manufacturer and Air Carrier Modules are provided in Sections II, III, and IV, respectively.

Flowcharts

Flowcharts of the logic of each of the routines in the ABC-ART models have been provided in Volume I of this report. Flowcharts for the Fleet Accounting, Airframe Manufacturer, and Air Carrier Modules are provided in Sections II, III, and IV, respectively.

Program Listing

Listings of the FORTRAN code for the ABC-ART models are provided in Volume II of this report. Program listings for the Fleet Accounting, Air-frame Manufacturer, and Air Carrier Modules are provided in Appendices C, D, and E, respectively.